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(54)【発明の名称】 表示シート及びそれを使用した表示装置

## (57)【要約】

【課題】 感光層に印字情報を露光すると簡単な方法で動作可能な表示シートを提供する。

【解決手段】 少なくとも、外部から帶電された電荷を輸送する電荷輸送層と、露光により電荷を発生する電荷発生層と、電荷を帶電する導電層と、該電荷により移動する少なくとも2色に着色した現像剤を保持した現像剤保持層と、該現像剤を移動する電荷を帶電する透明導電層を有し、該現像剤保持層における現像剤を電荷により移動することにより着色の表示を変えて画像を表す表示シート。

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## 【特許請求の範囲】

【請求項1】少なくとも、外部から帶電された電荷を輸送する電荷輸送層と、露光により電荷を発生する電荷発生層と、電荷を帶電する導電層と、該電荷により移動する少なくとも2色に着色した現像剤を保持した現像剤保持層と、該現像剤を移動する電荷を帶電する透明導電層を有し、該現像剤保持層における現像剤を電荷により移動することにより着色の表示を変えて画像を表すことを特徴とする表示シート。

【請求項2】前記現像剤は帶電している請求項1記載の表示シート。

【請求項3】前記現像剤のうち少なくとも一部には磁性体を含有している請求項1記載の表示シート。

【請求項4】請求項1乃至3のいずれかの表示シート、及び少なくとも該表示シートを帶電する帶電部材、表示シートを搬送する搬送部材、表示シートを現像し表示を変える現像部材、表示シートを露光する露光部材を有することを特徴とする表示装置。

【請求項5】上記現像部材はマグネットである請求項4記載の表示シート。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、表示シート及びそれを使用した表示装置に関する。

## 【0002】

【従来の技術】近年、情報機器の発達に伴い、各種情報のデータ量は拡大の一途をたどり、情報の出力も様々な形態を持ってなされている。一般に、情報の出力は、ブラウン管や液晶などを用いたディスプレイ表示とプリンタなどによる紙へのハードコピー表示とに大別できる。ディスプレイ表示においては、低消費電力、且つ薄型の表示装置のニーズが増しており、中でも液晶表示装置は、こうしたニーズに対応できる表示装置として活発な開発が行われ商品化されている。

【0003】しかしながら、現在の液晶表示装置には、画面を見る角度や、反射光により、画面上の文字が見づらく、また光源のちらつき・低輝度等から生じる視覚へ負担が、未だ十分に解決されていない。またブラウン管を用いたディスプレイ表示では、コントラストや輝度は液晶表示と比較して十分あるものの、ちらつきが発生するなど後述するハードコピー表示と比較して十分な表示品位があるとはいえない。また装置が大きく重いため携帯性が極めて低い。

【0004】一方、ハードコピー表示は情報の電子化により不要になるものと考えられていたが、実際には依然膨大な量のハードコピー出力が行われている。その理由として、情報をディスプレイ表示した場合、前述した表示品位に係わる問題点に加えて、その解像度も一般的には最大でも120dpi程度と紙へのプリント・アウト（通常300dpi以上）と比較して相当低い。従つ

て、ディスプレイ表示ではハードコピー表示と比較して視覚への負担が大きくなる。その結果、ディスプレイ上で確認可能であっても、一旦ハードコピー出力することがしばしば行われることになる。また、ハードコピーされた情報は、ディスプレイ表示のように表示領域がディスプレイのサイズに制限されることなく多数並べたり、また複雑な機器操作を行わずに並べ替えたり、順に確認していくことができることもディスプレイ表示可能であっても、ハードコピー表示も併用される大きな理由である。さらには、ハードコピー表示は、表示を保持するためのエネルギーは不要であり、情報量が極端に大きい限り、何時でもどこでも情報を確認することが可能であるという優れた携帯性を有する。

【0005】このように動画表示や頻繁な書き換えなどが要求されない限り、ハードコピー表示はディスプレイ表示と異なる様々な利点を有するが、紙を大量に消費するという欠点がある。そこで、近年においては、リライタブル記録媒体（視認性の高い画像の記録・消去サイクルが多数回可能であり、表示の保持にエネルギーを必要としない記録媒体）の開発が盛んに進められている。こうしたハードコピーの持つ特性を継承しつつ、書き換え可能である第3の表示方式をペーパーディスプレイと呼ぶこととする。

【0006】ペーパーディスプレイの必要条件は、書き換え可能であること、表示の保持にエネルギーを要しないか若しくは十分に小さいこと（メモリー性）、携帯性に優れること、表示品位が優れていること、などである。現在、ペーパーディスプレイとみなせる表示方式としては、例えば、サーマルプリンタヘッドで記録・消去する有機低分子・高分子樹脂マトリックス系（例えば、特開昭55-154198、特開昭57-82086）を用いた可逆表示媒体を挙げることができる。この系は一部プリペイドカードの表示部分として利用されているが、コントラストが余り高くないことや、記録・消去の繰り返し回数が150～500回程度と比較的少ないなどの課題を有している。

【0007】そこで新たな表示装置として、N. K. Sheridan等により電界駆動による微小ボールの回転を利用した表示装置が提案されている（“A Twisting Ball Display”, Proc. of the SID, 第18巻3/4号、289～293頁、1977年、米国特許4126854号、同4143103号、同5389945号、特開昭64-42683号）。

【0008】図18～20にその表示装置を示す。図18に於いて、100は表示部であり、110は透明部材、120は透明な電極支持体、121は平行透明電極、130は透明支持体、140は透明電極支持体、141は121と直交する平行透明電極、150は基板である。また図18A-A'の断面が図19である。図1

9に於いて、200は平行電極121と141間に印加するバイアスを示している。300は表示部を見る向で目の位置を示している。図20は透明支持体130の部分拡大図である。131は透明支持体130中にできたキャビティ、134は回転する微小なボールを示している。132はボール134の中でマイナスに帶電した白色部分、133はプラスに帶電した黒色部分を示す。135は高抵抗な液体である。

【0009】上記の構成に於いて、この表示装置は、微小なボール134を用い、該ボール134は一方の半球面132が白色で、他方の半球面133が黒色となっており、前記ボールを支持体に形成したキャビティ131内に配し、各キャビティ内に高抵抗な液体135を充填して、この液体中でボール134が自由に回転できるようにしたものである。この場合、高抵抗な液体135の種類により、ボールの黒色と白色の夫々の半球部分の相互の帶電状態が異なり、二次元マトリクス配線を用いて外部電界を与える事によってボールの白色又は黒色の半球面を観察する側にむけるよう回転を制御することができ、目的とする表示ができる。

【0010】このような機械式の表示方法は、温度変化、電気的優乱ノイズに対して極めて安定であり、メモリ性を有する為に表示中に電力を必要としない。さらに、ボール表面の自然光の反射・散乱を利用して表示する為に液晶装置・ブラウン管でみられるような光源のちらつき等にて起こる眼疲労を抑えることができる理想的な表示装置である。

#### 【0011】

【発明が解決しようとする課題】しかしながら図18に示したように、二次元マトリクス配線を作製する場合には、直交する平行電極配線が必ず必要となり製造が大変である。またより大きな、より高精細な表示部を作ろうとすると、更に製造が困難になると同時に、製造コストが上昇すると云う問題が発生した。

【0012】本発明、この様な従来技術の問題点を解決するためになされたものであり、表示装置に電子写真の原理を応用する事で、マトリクス配線の代わりに、感光層に印字情報を露光すると云う実に簡単な方法で動作可能な表示シート及びそれを使用した表示装置を提供することを目的とするものである。

【0013】また、本発明は、またより大きな、より高精細な表示部が容易に提供することで、製造コストも削減出来る表示シート及びそれを使用した表示装置を提供することを目的とするものである。

#### 【0014】

【課題を解決するための手段】即ち、本発明は、少なくとも、外部から帶電された電荷を輸送する電荷輸送層と、露光により電荷を発生する電荷発生層と、電荷を帶電する導電層と、該電荷により移動する少なくとも2色に着色した現像剤を保持した現像剤保持層と、該現像剤

を移動する電荷を帶電する透明導電層を有し、該現像剤保持層における現像剤を電荷により移動することにより着色の表示を変えて画像を表すことを特徴とする表示シートである。前記現像剤は帶電していること、および現像剤のうち少なくとも一部には磁性体を含有しているのが好ましい。

【0015】また、本発明は、上記の表示シート、及び少なくとも表示シートを帶電する導電部材、表示シートを搬送する搬送部材、表示シートを現像し表示を変える現像部材、表示シートを露光する露光部材を有することを特徴とする表示装置である。上記現像部材はマグネットであるのが好ましい。

#### 【0016】

【発明の実施の形態】本発明の表示シートは、少なくとも外部から帶電された電荷を輸送する電荷輸送層と、露光により電荷を発生する電荷発生層と、電荷を帶電する導電層と、該電荷により動く現像剤を保持した現像剤保持層と、該現像剤を動かす電荷を帶電する透明導電層を有することを特徴とする。

【0017】本発明に於いては、表示装置に電子写真の原理を応用する事で、マトリクス配線の代わりに、感光層に印字情報をレーザーで走査露光すると云う実に簡単な方法で上記の目的が達成出来る。

【0018】また、本発明の表示装置は、上記の表示シート、及び少なくとも表示シートを帶電する導電部材、表示シートを搬送する搬送部材、表示シートを現像し表示を変える現像部材、表示シートを露光する露光部材を有することを特徴とする。

【0019】本発明では、今までに無いポータブルな表示装置を提供する事が出来るようになったので、いつでも、どこにいても、必要な情報が入手可能である。また、追記入、消去、繰り返し使用が出来、従来のノートや紙と同じような感覚で使う事が可能な為、使い勝手が良く環境にも優しい表示装置が提供出来た。その上カラ一化が可能なのでより一層広い用途に使えるという効果もある。

#### 【0020】

【実施例】以下図面に沿つて、本発明の実施例に付いて説明する。

#### 【0021】実施例1

図1は本発明の表示シートの一実施例を示す説明図である。図中、1は表示シート、1-1は感光層1-9中の電荷輸送層であり、材料としては、例えばヒドラゾン系化合物、スチルベン系化合物、ピラゾリン系化合物、オキサゾール系化合物、チアゾール系化合物、トリアリールメタン系化合物などの電荷輸送材料及びアクリル樹脂、ポリエステル樹脂、ポリアリレート樹脂、ポリ塩化ビニル樹脂、ポリカーボネート樹脂、ポリビニルブチラート樹脂、ポリメタアクリレート樹脂などの熱可塑性樹脂；ポリウレタン樹脂、フェノール樹脂、エポキシ樹脂

などの熱硬化性樹脂などのバインダ樹脂をメタノール、エタノール、ブタノール、イソプロピルアルコールなどのアルコール類；メチルエチルケトン、アセトン、メチルイソブチルケトン、シクロヘキサンなどのケトン類；酢酸エチル、酢酸プロピルなどのエステル類；n-ヘキサン、石油エーテル、トルエンなどの炭化水素類；モノクロルベンゼン、ジクロロメタンなどのハロゲン化炭化水素など、その他の適當な溶媒に溶解させたもの、さらに必要に応じて添加剤を加えたものを塗布したもののが挙げられる。また導電性ポリマーなどが挙げられる。

【0022】1-2は感光層1-9中の電荷発生層であり、材料としては、例えばスーダンレッド、クロルダイアンプルーなどのアゾ顔料；銅フタロシアニン、チタニルフタロシアニンなどのフタロシアニン顔料；アントアンスロンなどのキノン顔料；ペリレン顔料、インジゴ顔料などの電荷発生材料をアクリル樹脂、ポリエステル樹脂、ポリアミド樹脂、ポリ酢酸ビニル樹脂、ポリカーボネート樹脂、ポリビニルブチラール樹脂、ポリビニルベンザール樹脂などの熱可塑性樹脂；ポリウレタン樹脂、フェノール樹脂、エポキシ樹脂などの熱硬化性樹脂などのバインダ樹脂に分散したものが挙げられる。さらに必要に応じた付加剤を加える事が可能である。

【0023】感光層1-9は電荷発生材料を含有する電荷発生層と電荷輸送材量を含有する電荷輸送層に機能分離した積層構造でも、電荷発生材料と電荷輸送材料を含有する層の単一構造であってもよい。

【0024】1-3は感光層を保持する為の導電層の導電性支持体である。材質の例としては、アルミニウム、銅、ニッケル、銀などの金属またはこれらの合金；酸化アンチモン、酸化インジウム、酸化スズなどの導電性金属酸化物、カーボンファイバー、カーボンブラック、グラファイト粉末と樹脂を混合成型した物などが挙げられる。本実施例ではアルミシートを使用した。

【0025】さらに、支持体上の欠陥の被覆、支持体の保護の為に支持体上に導電層を設ける事も可能である。例えば、アルミニウム、銅、ニッケル、銀などの金属粉体；酸化アンチモン、酸化インジウム、酸化スズなどの導電性金属酸化物；ポリビロール、ポリアリニン、高分子電解質などの高分子導電材料；カーボンファイバー、カーボンブラック、グラファイト粉末；またはこれらの導電性材料をアクリル樹脂、ポリエステル樹脂、ポリアミド樹脂、ポリ酢酸ビニル樹脂、ポリカーボネート樹脂、ポリビニルブチラール樹脂などの熱可塑性樹脂；ポリウレタン樹脂、フェノール樹脂、エポキシ樹脂などの熱硬化性樹脂；光硬化性樹脂などのバインダ樹脂に分散したもの、更に必要に応じて添加材を加えたものを支持体上に塗布した物が挙げられる。

【0026】また導電性支持体1-3の電荷発生層とは反対側に絶縁層を配置しても良い。トナー上の電荷が導電性支持体1-3へ逃げ易い場合、この層があれば、逃

げるのを防止する事が出来、現像剤の寿命を延ばす事が出来る。さらに、導電性支持体1-3や上記絶縁層が透明の場合は、6-1の位置から見た図と反転した図を露光側から見る事が出来る。

05 【0027】1-4は多数の孔を開けた現像剤保持層である絶縁シートであり、孔の中に互いに帶電極性の異なる現像剤（以下、トナーと記す）を保持する機能を有する。図2に絶縁シート1-4の拡大図を示す。本実施例では孔はレーザーで1mm×0.5mmの孔を行方向  
10 1.2mm、列方向0.7mmピッチで開けた。孔のサイズは中のトナーが振動等で片寄らない条件で決めた。また、孔と孔の境のリブの幅は、薄ければ薄いほど良いが、トナーサイズと同等まで薄く出来れば理想的である。孔の作成方法は上記以外にも、パンチで開けたり、  
15 ドリルで一つづつ開けてもよい。またエッチングで開けてもよい。シート材料は絶縁性であればよく、ポリイミドシート、アクリルシート、ポリカーボネートシート、PETシート等が使用可能である。または絶縁性の糸を編んだメッシュでも良く、更にはフィルター状の不織布  
20 であってもよい。更に、導電性のシートであっても構わないが、この場合は、メッシュの上下の導電面1-3と1-5-1に接する部分に絶縁処理を施す必要がある。この絶縁シートはある程度外部から衝撃が加わっても中のトナーが片寄らない様にすることを目的とするので、  
25 メッシュ又は不織布状のシートであっても、衝撃が加わった時のトナーの移動が極端に大きくなれば十分に実用に耐えるのである。

【0028】図3に於いて、1-5は透明な片面導電シートである。1-5-1は透明絶縁シートであり、材料  
30 は本実施例ではPETを使用した。1-5-2は導電層であり、本実施例では主に酸化インジウムから成る導電層である。1-5-2は常にグランドに接地されている。本実施例では透明導電シート1-5は出光興産（株）の透明導電シート「IDIXO/PET」を使用  
35 した。この様な構成にすれば、トナーの電荷を逃がし難く、透過率の高い表示面を得る事が出来る。また、1-5は透明であれば一層の導電シートでも良い。たとえば、PETやポリカーボネート、アクリル板にカーボンを分散させた一層透明導電シートでも、トナーの電荷が  
40 逃げ難い場合や、一層透明導電シートの透過率が十分に高い場合には、同様な表示機能が得られる。

【0029】1-6はマイナスに帶電した非磁性の白トナーである。サイズは粒径5μmのものを使用した。また1-7はプラスに帶電した黒の磁性トナーである。サ  
45 イズは粒径10μmである。

【0030】トナーの結着樹脂の種類としては、ポリエステル樹脂、スチレンアクリル樹脂等の公知のトナー用結着樹脂を適宜選択すれば良い。マイナス非磁性の白トナー1-6の顔料としては、酸化チタン、酸化亜鉛、硫酸バリウム、アルミナ、炭酸カルシウム等の一つ以上の

材料を用いれば良い。またプラス磁性黒トナー1-7の顔料は、カーボンブラック、酸化銅、二酸化マンガン、アニリンブラック、活性炭、非磁性フェライト、マグネットタイトなどが挙げられる。

【0031】これらの電荷制御剤としては例えば、正荷電制御剤として、ニグロシン系染料、トリフェニルメタン系染料、4級アンモニウム塩、グアニジン誘導体、イミダゾール誘導体、アミン系化合物等が挙げられ、負荷電制御剤としては、含金属サリチル酸系化合物、含金属モノアゾ系染料化合物、尿素誘導体、スチレンーアクリル酸共重合体、スチレンーメタクリル酸共重合体が挙げられる。

【0032】図3を用い表示シート1の作成方法を示す。まず孔開き絶縁シート1-4の片面に接着剤1-8をローラ7で塗布する。次いで孔開き絶縁シート1-4の接着剤塗布面を透明導電シート1-5の絶縁面に乗せ貼りあわせる。しっかりと乾いた所で、ボトルの中で十分攪拌し互いに逆極に帯電したプラス磁性黒トナー1-7とマイナス非磁性白トナー1-6を孔開き絶縁シート1-4の中に入れる。その後ゴムへら等で余分なトナーをすりきった後に、再びローラ7で接着剤1-8を塗布する。そして最後に感光層の形成されたアルミシートの導電性支持材1-3のアルミ面を孔開き絶縁シート1-4の接着剤の塗布されている面にのせ、貼りあわせる事で表示シート1を作製した。この様にして作られた表示シート1の厚みはおよそ1mmである。

【0033】更に、図1に於いて、2は表示シート1を帯電する為の帯電ゴムローラであり、不図示の高圧電源から電圧が印加されている。3は現像用マグネットローラであり、4は搬送ローラである。材料は絶縁体であるE P D Mやウレタンで出来ており、図に示すように、電気的にフロートの状態になっている。搬送ローラ4は帯電ローラ2と対を成し、表示シート1を矢印方向に搬送する。5-1は印字情報を表示シート1に書き込む為のレーザー光である。これはLEDアレイからの光であっても良い。6-1は、可視化された情報を見る目の位置を示している。

【0034】この様な構成に於いて、まず表示シート1は帯電ローラ2でその表面を-500Vに帯電される。この時、帯電ローラ2に印加されるバイアスは、直流-500Vにピークツーピークで1700Vの交流を重畠したものである。表示シート1は帯電ローラ2と搬送ローラ4により図中矢印の向きに搬送される。

【0035】図4を用いて詳細に説明する。帯電ローラ2を通過した後の表示シート1中のプラス磁性黒トナー1-7は図中上側に、マイナス非磁性白トナー1-6は下側に移動している。これは次のように説明出来る。つまり電気的にフロート状態のアルミシート1-3の内部は、電荷輸送層1-1の表面のマイナスの電荷に引っ張られ、上側にプラス、下側にマイナスが分極する。そし

てプラス磁性黒トナー1-7はこのマイナスの電荷にクーロン力で引き寄せられ上側に移動するのである。同時に、マイナス非磁性白トナー1-6は、接地した透明導電層1-5-2のグランドから誘起したプラスの電荷に引き寄せられ下側に移動する。

【0036】次に、搬送された表示シート1が露光位置に来ると、レーザーからの印字情報が表面に書き込まれる。するとレーザーの当たった所は、電荷発生層1-2で電荷が発生し、その電荷は、電荷輸送層1-1を介して表示シート1表面のマイナス電荷をディスチャージする。その結果、アルミシート1-3の中で分極していた電荷が無くなり、プラス磁性黒トナー1-7を引き付けていたアルミシート1-3中のマイナス電荷も消失する。同時に透明導電シート1-5の導電面1-5-2に誘起していた電荷もグランドに戻り、トナーを両側に引っ張っていた力が消失する。

【0037】この時、自由になったプラス磁性黒トナー1-7は現像マグネットローラ3によって下側に引かれ、反対にマイナス非磁性白トナー1-6は上側に追いやられることになる。その結果、レーザーの当たった所はマグネット側の位置から見れば、黒く発色し、レーザーの当たらなかった所は、マグネットに引かれる力よりも表示シート1に帯電した電荷に引かれる力が大きくなるように設定してあるので、プラス磁性黒トナー1-7は移動せず白のままなのである。

【0038】またその後、電荷発生層1-2が外光5-2を全面に浴びて電荷を発生し表示シート1表面の電荷をディスチャージしても、プラス磁性黒トナー1-7を移動させるマグネット3はその位置には無い事と、プラス磁性黒トナー1-7とマイナス非磁性白トナー1-6の充填密度が最適化されているので、トナーの移動はなく、印字情報はそのまま保持される。また外光により感光層表面にマイナスの電荷が消失するので、その電荷に付着する埃も無い。

【0039】最後に図1中の矢印と反対方向に表示シート1を移動することで、マグネットによりトナーの位置はリセットされプラス磁性黒トナー1-7は下側に移動する。そして新しいサイクルが始まると、表示シート1は矢印の方向に移動を始め、バイアスが印加されている帯電ローラ2により、全面にわたり均一に、下側にはマイナス非磁性白トナー1-6、上側にはプラス磁性黒トナー1-7が来る。

【0040】図5は実施系の斜視図である。図中8-1は書き込み用のペンである。8-2はペン8-1が消失しない為の紐、8-3はペン8-1を入れる為のスペースである。8-1は先端にマグネットが付いており、これで表示シート1の表面をなぞれば、プラス磁性黒トナー1-8が引き寄せられ、可視像となって現れるのである。図中「D」はこの様にして書き込んだ物である。また逆に表示シート1の裏側からペン8-1でなぞれば書

いてある情報を消す事も可能である。

【0041】9は印字情報の内容や受信先、送り先等を確認する為の液晶表示部、10は操作する際に使用するキーボード、11は電波に乗った印字情報を受信する為のアンテナ、12は本体筐体部を示す。この様な構成になっているので、表示シート1は左右に往復を繰り返す事で、新しい印字情報を表示する事が出来る。また、複数の表示シート1を準備しておき、一枚情報を書き込むごとに新しい表示シート1に交換する事で、あたかも紙に印刷したような使い方も出来る。

【0042】図6は図5の実施系を丸めた状態を示す。表示シート1は柔軟な構造なので、図のように簡単に丸める事が出来る。その結果、コンパクトに収納出来るので、かさばらず持ち運びに便利である。

【0043】また図7に示すように、表示シート1を折りたたむ事も可能である。この場合、この表示装置はバラバラとめくる事が可能となり、通常のノートと同じような感覚で使う事が出来る。

#### 【0044】実施例2

図8にリセット工程と書き込み工程を一つの工程にした場合を示す。2-1、2-2は導電性帯電ローラで交互に表示シート1に圧接出来る構造になっている。4-1、4-2は絶縁性搬送ローラで電気的にはフロートになっている。

【0045】図8では、帯電ローラ2-2は表示シート1から離れており、図1で説明した工程と同じ方法で印字情報の書き込みが行われ6-1の目の位置で印字情報を確認する事が出来る。

【0046】次に図9ではリセットと同時に印字情報の書き込みを行う様子を示す。まず図の矢印方向に戻ってきた表示シート1は帯電ローラ2-2で帯電される。この時すべてのプラス磁性黒トナー1-7は上側に移動するので、表示シート1の画面はこの工程でリセットされる。

【0047】同時に表示シート1は帯電ローラ2-2と搬送ローラ4-2に挟まれて矢印方向に送られる。次にレーザー5-1の印字情報の書き込まれた部分のプラス磁性黒トナー1-7はマグネット3により引き寄せられて下側に移動する。その先の帯電ローラ2-1は表示シート1に対し非接触の位置にあるので、印字パターンはなんら乱されることなく6-2の目視確認位置に達するのである。

【0048】この様な構成にする事で、表示シート1の往復の動作で、その都度印字情報が書き込められる事になり、印字スピードを倍増する事が出来る様になった。

#### 【0049】実施例3

図10に第3の実施例を示す。表示シート1をループ状にする事でエンドレス表示が可能になった。14は表示シート1を内側から支える支持板であり腰のある柔軟な材料で出来ている。本実施例では厚さ0.5mmのアクリル板を使用した。また支持板に更に薄い物を用いれば、図6のように丸めてコンパクトにする事も可能である。13は支持板14を支える為の底である。さらに支持板は片側のみでなく本体12の両側にあっても良い。

05 この場合表示面積が倍増するメリットも出てくる。

#### 【0050】実施例4

図11に第4の実施例を示す。本実施例では短時間に、複数の表示シート1の情報を書き換える事を特徴としている。15-1はばね性の有るワイヤ、15-2はエンドレスな表示シート1の摺動を助ける為のアクリル樹脂で出来たコロである。図12は図11を上から見た図である。この様な構成になっているので、表示シート1を見開き状に出来る。従ってより実際のノートや週刊誌の使用形態にあった使い方、例えば満員電車の中等で15は有効である。さらにそれぞれの頁の出口に帯電、露光、現像部が構成されているので、短時間に比較的多くの情報を狭い所で見たい時などは、特に有効である。

#### 【0051】実施例5

図13に第5の実施例を示す。この場合、表示頁を更に20増やして有るので、実際に本を読むような感覚で、情報を見る事が可能になる。図14は図13を上から見た図である。この例では帯電、露光、現像部は一個所にしか配置していないが、これは情報量は多いが、たまにしか変わらない情報、例えば時刻表等の表示に有効である。

25 また小説等の表示にも有効な事は云うまでもない。

#### 【0052】実施例6

図15に第6の実施例を示す。本実施例では二色に着色された微小ボール1-9の回転を利用している。微小ボール1-9の作製方法としては、ガラスボールにTiO<sub>2</sub>を高濃度に含有させガラスボールを白色化し、この白色ガラスボールの半球面に真空蒸着法を用いて強磁性体の黒色層1-9-1を形成した。蒸着されない部分が白部1-9-2となる。粒径は20μmとした。また蒸着源としては、鉄、ニッケル、コバルト等の強磁性体を用いた。また1-10はシリコンオイル等の透明な粘度の高い絶縁性の液体であり、微小ボール1-9の回転をスムーズに行うと共に、微小ボール1-9に帯電した電荷を保持する働きと、いったん決まった向きは外部からの振動程度では変化させない微小ボール1-9の保持機能40も持っている。

【0053】微小ボール1-9への帯電は、マグネットを用いて、上向きにした状態で、上からコロナ放電により行った。逆極への帯電も同様に、マグネットを用い、微小ボール1-9を下向きにした状態で行った。その後、シリコンオイル1-10の注入を行った。

【0054】上記のような構成になっているので、印字情報5-1の当たった感光層の電荷がその部分だけ電荷発生層から発生した電荷により消滅する。次いで、微小ボール1-9を保持する力はなくなり、強磁性体の黒色層1-9-1は、マグネット3により引かれる。その結果50

果、微小ボール1-9は、回転する。ゆえに、6-1の位置から見ると、レーがーの当たった所は黒くなつて見える。さらに、表示シート1が矢印方向に進んで、外光5-2で感光層表面の電荷が消去しても、その位置にはマグネットが無いのと、粘度の高いシリコンオイル1-10のために、微小ボール1-9の向きは保持され、メモリー効果となって印字情報を保持する事が出来る。

## 【0055】実施例7

図16に第7の実施例を示す。この場合現像剤に液体現像剤を用いた所に特徴がある。1-11はプラスに帯電した黒色磁性顔料であり、その製法は、水500g、カ

プラス磁性黒色顔料

ラウリルメタクリレート・メタクリル酸共重合体 100g

アイソパーG/H

よりなる混合物をボールミルにて18時間攪拌し、その160gをアイソパーG/H 1リットルで希釈し、白色樹脂顔料VONCOAT PP-200Sを50g投入、攪拌し液体現像剤を得た。また必要に応じて、顔料の荷電制御剤を添加しても良い。

【0057】図16を用いて詳細に説明する。帯電ローラ2を通過した後の表示シート1中のプラス磁性黒色顔料1-11は図中上側に、マイナス非磁性白色樹脂顔料1-12は下側に移動している。これは次のように説明出来る。つまり電気的にフロート状態のアルミシート1-3の内部は、電荷輸送層1-1の表面のマイナスの電荷に引っ張られ、上側にプラス、下側にマイナスが分極する。そしてプラス磁性黒色顔料1-11はこのマイナスの電荷にクーロン力で引き寄せられ上側に移動する。同時に、マイナス非磁性白色樹脂顔料1-12は、接地した透明導電層1-5のグランドから誘起したプラスの電荷に引き寄せられ下側に移動するのである。

【0058】次に、搬送された表示シート1が露光位置に来ると、レーザーからの印字情報が表面に書き込まれる。するとレーザーの当たった所は、電荷発生層1-2で電荷が発生し、その電荷は、電荷輸送層1-1を介して表示シート1表面のマイナス電荷をディスチャージする。その結果、アルミシート1-3の中で分極していた電荷が無くなり、プラス磁性黒色顔料1-11を引き付けていたアルミシート1-3中もマイナス電荷も消失する。同時に透明導電シート1-5の導電面に誘起していた電荷もグランドに戻り、トナーを両側に引っ張っていた力が消失する。

【0059】この時、自由になったプラス磁性黒色顔料1-11は現像用マグネットローラ3によって下側に引かれ、反対にマイナス非磁性白色樹脂顔料1-12は上側に追いやられることになる。その結果、レーザーの当たった所はマグネット側の位置から見れば、黒く発色し、レーザーの当たらなかった所は、マグネットに引かれる力よりも表示シート1に帯電した電荷に引かれる力が大きくなるように設定してあるので、プラス磁性黒色

一ポン（モーガルA）（キャボット社製）100gをフランジャーで充分攪拌後、これにフローラードFC-721（3M社製、弗素樹脂）100g、強磁性金属のコバルト粉末10gとトルエン100gを加え120℃で加

05 热攪拌した。約4時間混連後冷却し、揮発分を除去した後粉碎した。顔料粒径は20~50μm、含水分は1.2%であった。1-12はマイナスに帯電した非磁性白色樹脂顔料でありVONCOAT PP-200S（大日本インキ社製）を使用した。粒径は0.1~20μm 10 である。1-13はアイソパーG/Hである。

## 【0056】次に、

10g

ラウリルメタクリレート・メタクリル酸共重合体 100g

100g

15 顔料1-11は移動せず、マイナス非磁性白色樹脂顔料1-12の示す白色のままなのである。

【0060】またその後、電荷発生層1-2が外光5-2を全面に浴びて電荷を発生し表示シート1表面の電荷をディスチャージしても、プラス磁性黒色顔料1-11 20 を移動させるマグネット3はその位置には無い事と、プラス磁性黒色顔料1-11とマイナス非磁性白色樹脂顔料1-12の充填密度が最適化されているので、顔料の移動はなく、印字情報はそのまま保持される。また外光により感光層表面にマイナスの電荷が消失するので、そ 25 の電荷に付着する埃も無い。

【0061】その後、図16中の矢印と反対方向に表示シート1を移動することで、マグネットにより顔料の位置はリセットされプラス磁性黒色顔料1-11は下側に移動する。そして新しいサイクルが始まるとして、表示シート1は矢印の方向に移動を始め、バイアスが印加されている帯電ローラ2により、全面にわたり均一に、下側にはマイナス非磁性白トナー1-6、上側にはプラス磁性黒トナー1-7が来るのである。顔料がアイソパー等の溶媒に浮いている場合には、顔料の移動がスムーズに出来るようになるというメリットがある。

## 【0062】実施例8

図17に第8の実施例を示す。本実施例では、表示シート1のカラー化を行っている。1-6はマイナス非磁性白トナー、1-7-1はプラス磁性マゼンタトナー、1-7-2はプラス磁性シアントナー、1-7-3はプラス磁性イエロートナーである。図に示すように、三色のトナーは絶縁シート1-4のセルの中に、別々に入れられている。一方白トナーは全部のセルの中に入れられている。セルサイズは600μm×300μmである。ト 40 ナー粒径は四色ともほぼ同じで約5μmである。

【0063】トナーの結着樹脂の種類としては、ポリエスチル樹脂、スチレンアクリル樹脂等の公知のトナー用結着樹脂を適宜選択すれば良い。マイナス非磁性白トナー1-6の顔料としては、酸化チタン、酸化亜鉛、硫酸 45 パリウム、アルミナ、炭酸カルシウム等の一つ以上の材

料を用いれば良い。またプラス磁性マゼンタトナー1-7-1の顔料としては、パーマネントレッド、レーキレッドが、プラス磁性シアントナー1-7-2の顔料としては、フタロシアニンブルー、インダスレンブルー、ピーコックブルーが、プラス磁性イエロートナー1-7-3の顔料としては、ハンザイエロー、パーマネントイエロー、ベンジンイエロー等広く利用する事が出来る。またこれらの荷電制御剤としては、正荷電制御剤としては実施例1で紹介した材料と同じのものがつかえる。

【0064】上記の構成に於いて、各セルに対応した画像信号を、レーザー又はLEDアレイからの光信号として照射する事で、カラー画像が作製出来るのである。

【0065】

【発明の効果】以上説明したように、本発明に於いては、表示装置に電子写真の原理を応用する事で、マトリクス配線の代わりに、感光層に印字情報を露光すると云う実に簡単な方法で動作可能な表示装置を提供する事が可能になる。またより大きな、より高精細な表示部の製造が容易になることで、製造コストも削減出来るようになった。

【0066】さらに今までに無いポータブルな表示装置を提供する事が出来るようになったので、いつでも、どこにいても、必要な情報が入手可能になった。また、追記入、消去、繰り返し使用が出来、従来のノートや紙と同じような感覚で使う事が可能な為、使い勝手が良く環境にも優しい表示装置が提供出来た。その上カラー化が可能なのでより一層広い用途に使えるという効果もある。

【図面の簡単な説明】

【図1】本発明の実施例1の表示シートを示す説明図である。

【図2】本発明の実施例1の絶縁シートの拡大図である。

【図3】本発明の実施例1の表示シートの形成工程を示す図である。

【図4】本発明の実施例1の表示シート内の電荷の動きを示す図である。

【図5】本発明の実施例1の製品形態の一例を示す図である。

【図6】図5の部分説明図である。

【図7】図5の部分説明図である。

【図8】本発明の実施例2のリセット工程と書き込み工程を一つの工程にした場合を示す図である。

【図9】図8の工程の他の例を示す図である。

【図10】本発明の実施例3の表示シートをループ状に

した場合を示す図である。

【図11】本発明の実施例4の表示シートを見開き状にした場合を示す図である。

【図12】図11の部分説明図である。

05 【図13】本発明の実施例5の表示シートを本のよう表示頁を増やした場合を示す図である。

【図14】図13の部分説明図である。

【図15】本発明の実施例6の表示シートに於いて、二色に着色された微小ポールを示す図である。

10 【図16】本発明の実施例7の表示シートに於いて、現像剤に液体現像剤を用いた場合を示す図である。

【図17】本発明の実施例8の表示シートに於いて、カラー化の場合を示す図である。

【図18】従来の表示シートを示す図である。

15 【図19】図18のA-A'の断面図である。

【図20】従来の表示シートの部分拡大図である。

【符号の説明】

1 表示シート

2 帯電ゴムローラ

20 3 現像用マグネットローラ

4 搬送ローラ

5 露光

6 目の位置

7 接着剤塗布ローラ

25 8 ペン

9 液晶表示

10 キーボード

11 アンテナ

12 本体

30 13 底

14 支持板

15 ワイヤ

100 表示部

110 透明部材

35 120 電極支持体

130 透明支持体

131 キャビティー

132 白色部分

133 黒色部分

40 134 微小ポール

135 高抵抗液体

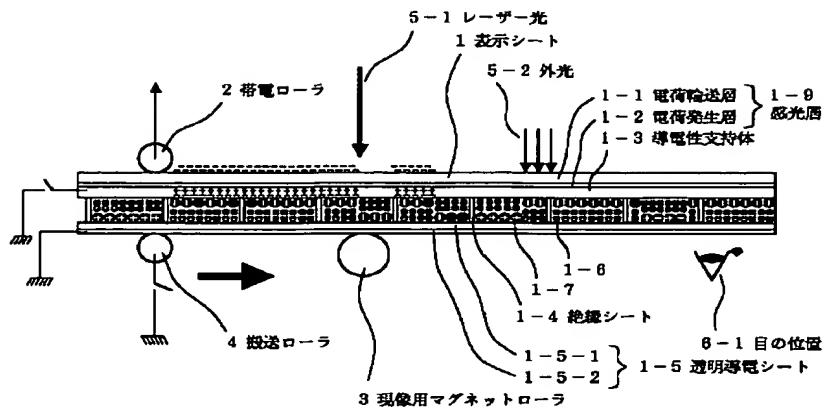
140 透明電極支持体

150 基板

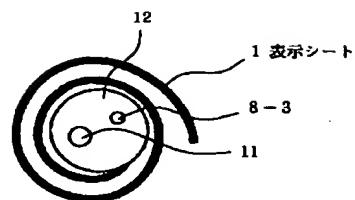
200 バイアス

45 300 目の位置

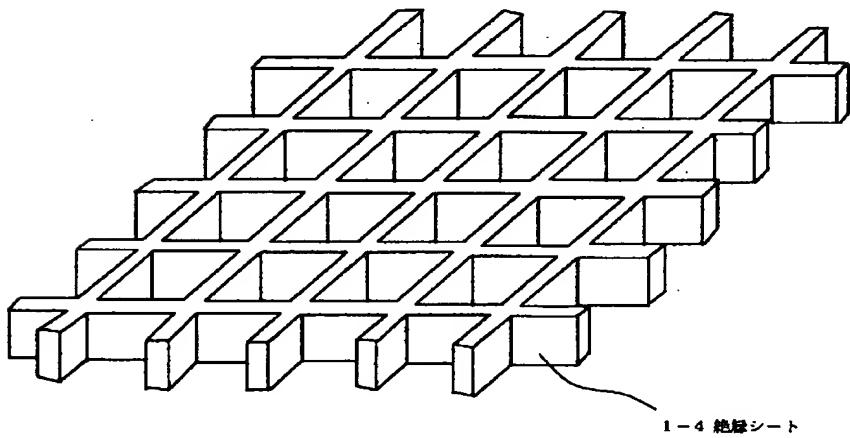
【図1】



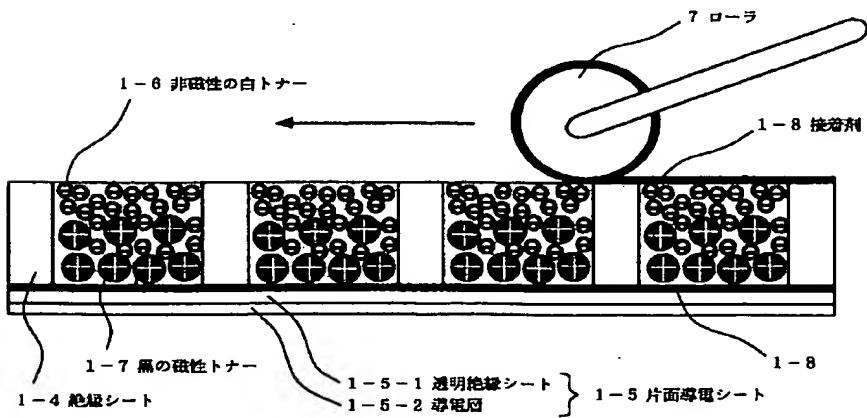
【図6】



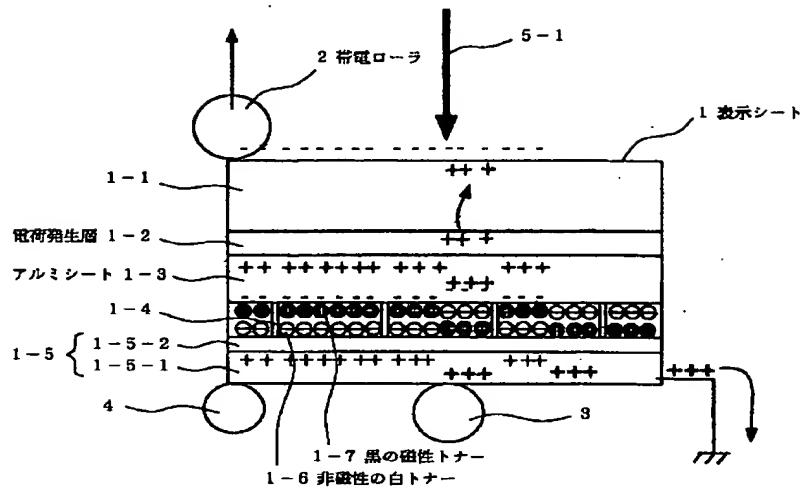
【図2】



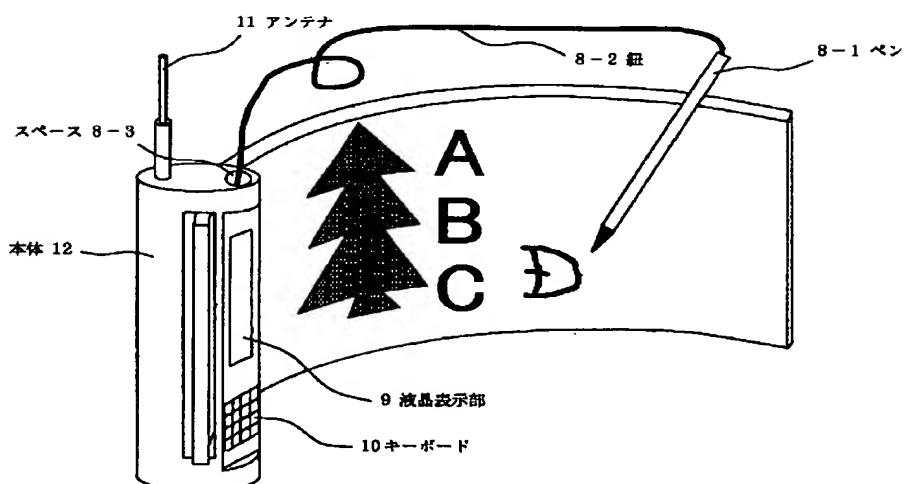
【図3】



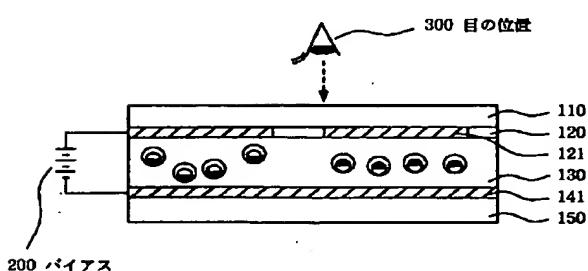
【図4】



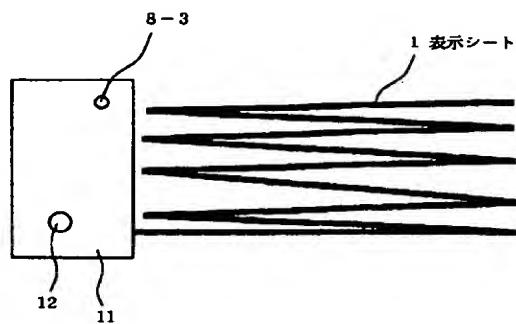
【図5】



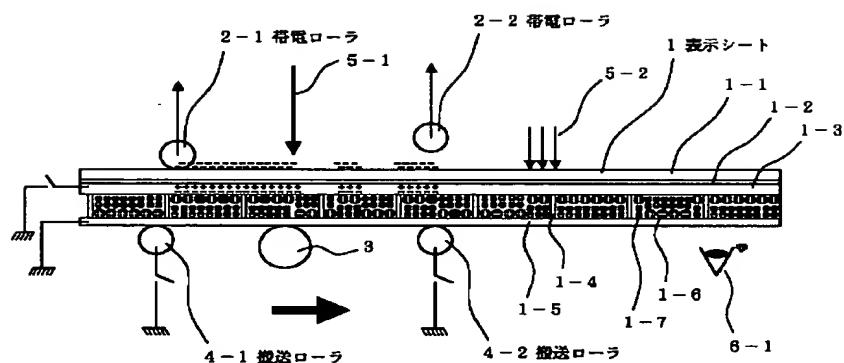
【図19】



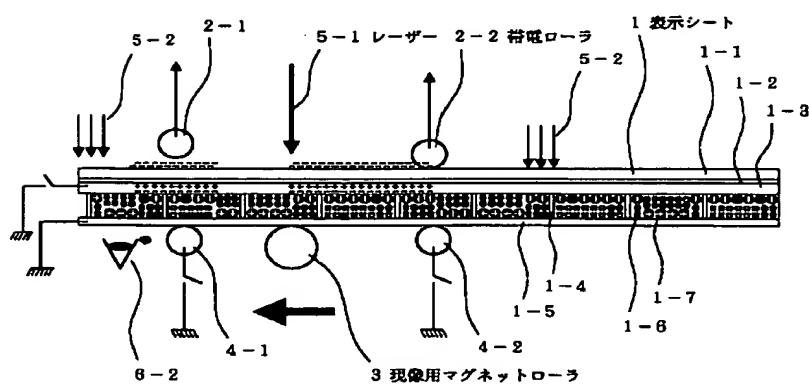
【図7】



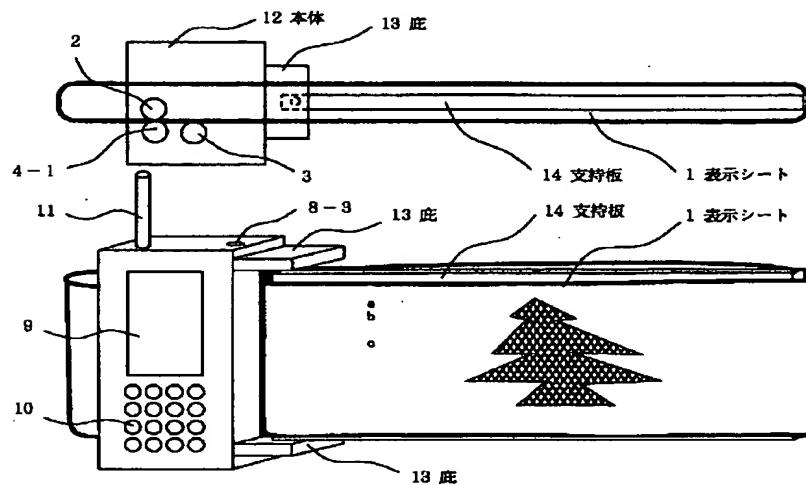
【図8】



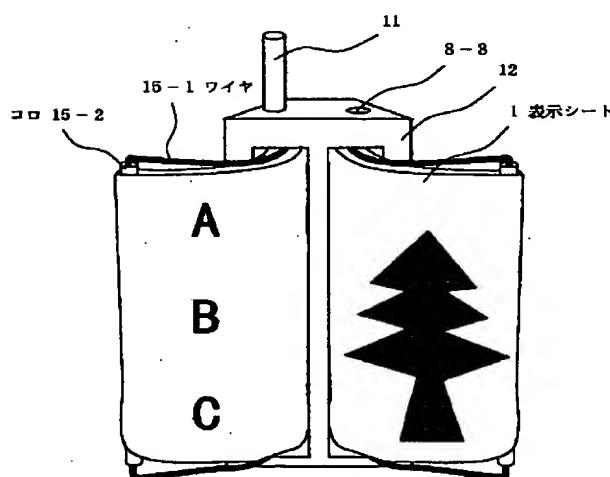
【図9】



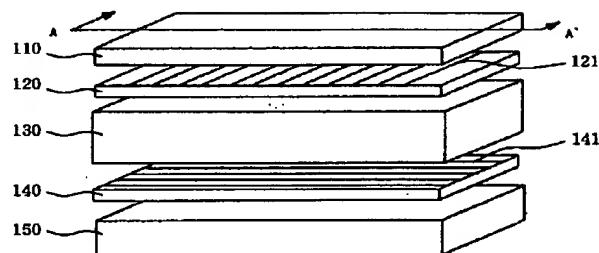
【図10】



【図11】

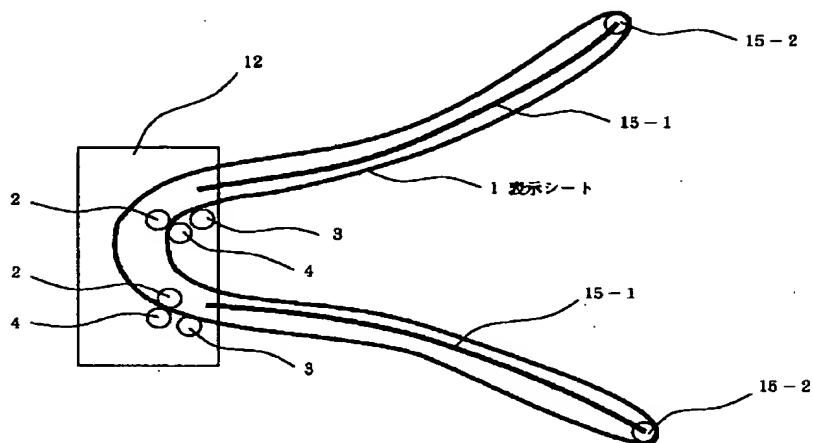


【図18】

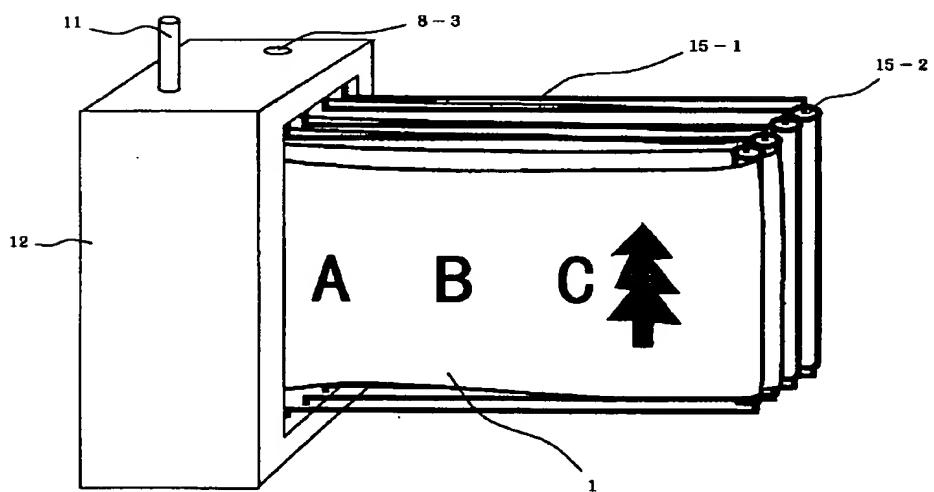


110 透明部材  
 120 電極支持体  
 121 平行透明電極  
 130 透明支持体  
 140 透明電極支持体  
 141 平行透明電極  
 150 基板

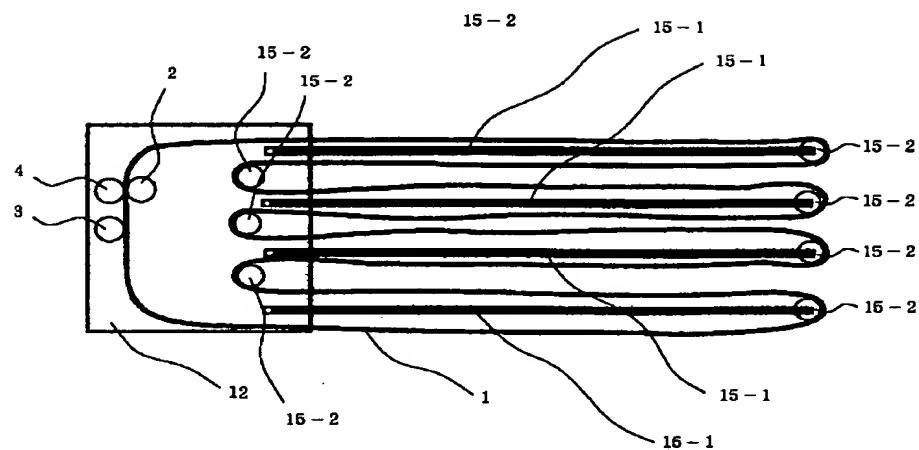
【図12】



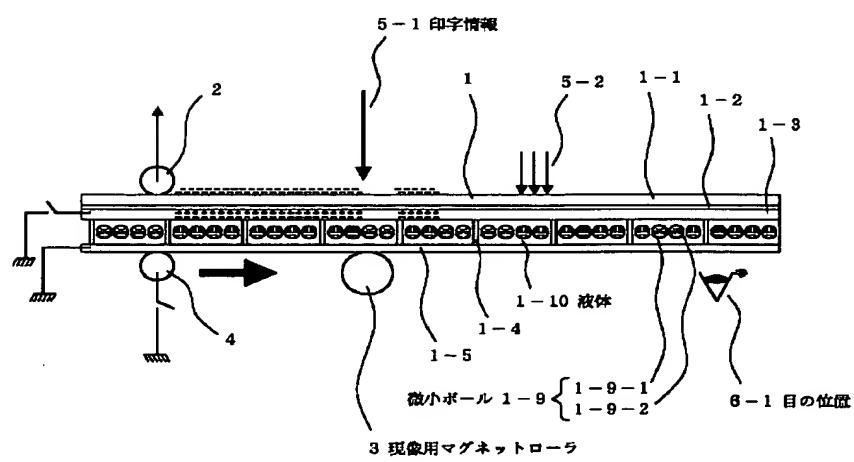
【図13】



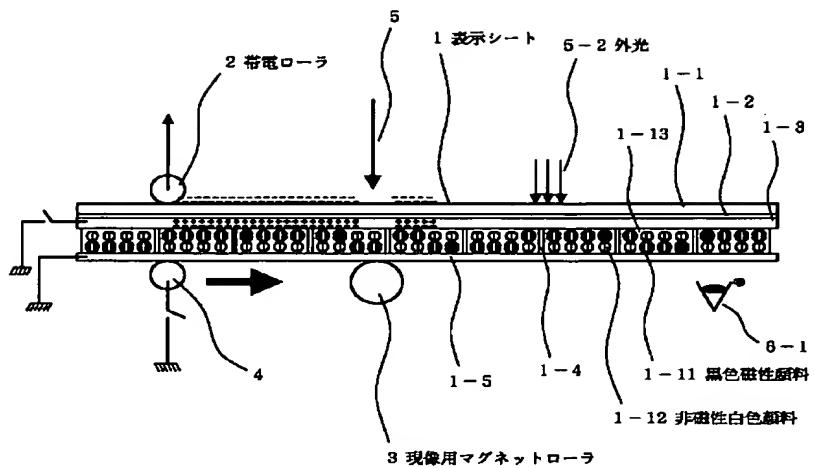
【図14】



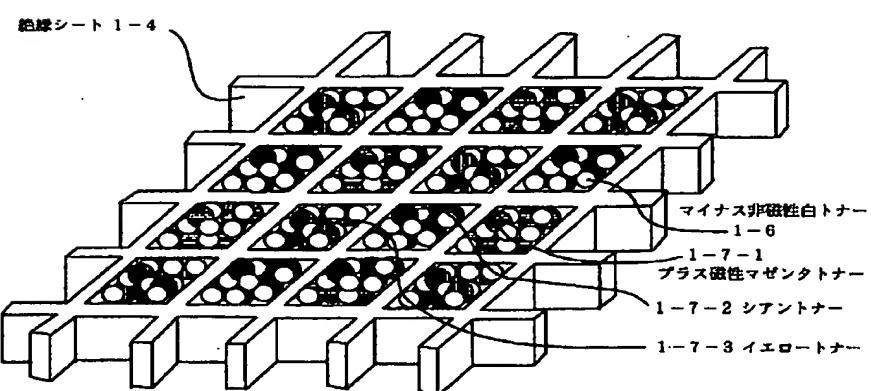
【図15】



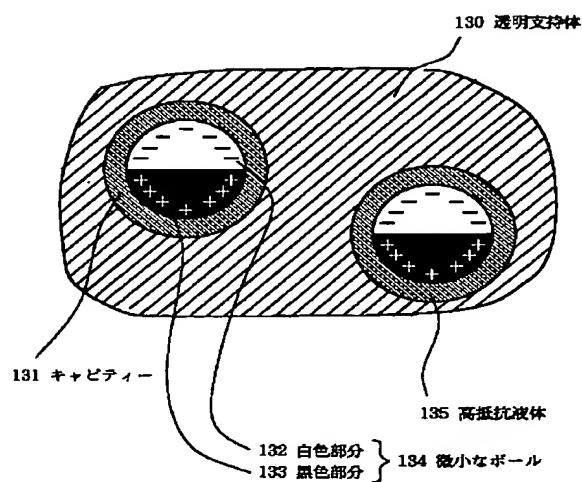
【図16】



【図17】



【図20】



**JAPANESE**

[JP,2000-098803,A]

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CLAIMS DETAILED DESCRIPTION TECHNICAL FIELD PRIOR ART EFFECT OF THE  
INVENTION TECHNICAL PROBLEM MEANS EXAMPLE DESCRIPTION OF  
DRAWINGS DRAWINGS

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[Translation done.]

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2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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## DETAILED DESCRIPTION

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### [Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the display which used a display sheet and it.

[0002]

[Description of the Prior Art] In recent years, with development of information machines and equipment, expansion of the amount of data of various information is enhanced, and the informational output is also made with various gestalten. Generally, an informational output can be divided roughly into the display display which used the Braun tube, liquid crystal, etc., and a hard copy display on the paper by the printer etc. In the display display, the needs of the display of a low power and a thin shape are increasing, especially, development active as display which can respond to such needs is performed, and the liquid crystal display is commercialized.

[0003] However, the burden is yet solved fully by the present liquid crystal display neither to the angle which looks at a screen, nor the visual sense which the character on a screen does not look at but is produced from \*\*\*\*, a flicker, low brightness of the light source, etc. by the reflected light. Moreover, in the display display using the Braun tube, neither contrast nor brightness can say enough that there is sufficient display grace as compared with the hard copy display which a flicker of a certain thing generates and etc.-mentions later as compared with a liquid crystal display. Moreover, since equipment is large and heavy, portability is a low very much.

[0004] On the other hand, although it was thought that a hard copy display became unnecessary by informational electronic processing, the hard copy output of an amount huge actual still is performed. In addition to the trouble concerning the display grace mentioned above as the reason when the information was indicated by the display, generally the resolution is also measured with about 120 dpi and the print-out (usually 300 or more dpi) to paper at the maximum, and it is a considerable low. Therefore, in a display display, the burden to a visual sense becomes large as compared with a hard copy display. Consequently, even if a check is possible on a display, once carrying out a hard copy output will often be performed. Moreover, the information by which hard copy was carried out is the big reason a hard copy display is also used together, even if a display display is possible for the ability to rearrange, without performing complicated device operation, or also check [, ] in order, without restricting a viewing area to the size of a display like a display display. [ putting a large number in order ] Furthermore, unless the energy for a hard copy display holding a display is unnecessary and amount of information is extremely large, it has the outstanding portability that it is possible to check information always anywhere.

[0005] Thus, although a hard copy display has different various advantages from a display display unless animation display, frequent rewriting, etc. are required, there is a fault of

consuming paper in large quantities. Then, in recent years, development of a lilac ITABURU record medium (record medium with which many times is possible for record / elimination cycle of the high picture of visibility with record medium, and it does not need energy for maintenance of a display) is furthered briskly. The 3rd rewritable means of displaying will be called paper display, inheriting the property which such hard copy has.

[0006] The requirements of a paper display are that it can rewrite, that there is no \*\*\*\* in maintenance of a display about energy, or it is fully small (memory nature), excelling in portability, that display grace is excellent, etc. Now, as means of displaying it can be considered that is a paper display, the reversible display medium using low-molecular [ organic ] and the macromolecule resin matrix unit (for example, JP,55-154198,A, JP,57-82086,A) recorded and eliminated by the thermal printer head can be mentioned, for example. Although a part of this system is used as a part for the display of a prepaid card, contrast's not being so high and the number of times of a repeat of record and elimination have about 150 - 500 times, and technical problems, such as being comparatively few.

[0007] then, the display which used rotation of the minute ball by electric-field drive by N.KSheridon etc. as new display is proposed ("A Twisting Ball Display", Proc.of the SID, volume [ 18th ] No. 3/4, 289-293 pages, 1977, and U.S. JP,4126854,B -- said -- No. 4143103 -- said -- No. 5389945 and JP,64-42683,A)

[0008] The display is shown in drawing 18 -20. The parallel transparent electrode to which in an parallel transparent electrode and 130 a transparent base material and 140 [ a transparent-electrode base material and ] cross at right angles, and 121 and 141 cross [ electrode support with 110 / in drawing 18 , 100 is a display and transparent / a transparent member and 120 ] and 121 / at right angles, and 150 are substrates. Moreover, the cross section of drawing 18 A-A' is drawing 19 . In drawing 19 , 200 shows the bias impressed between a parallel pole 121 and 141. 300 shows the position of an eye by Mukai who looks at a display. Drawing 20 is the elements on larger scale of the transparent base material 130. The mold cavity by which 131 was made into the transparent base material 130, and 134 show the rotating minute ball. The white portion to which 132 was charged in minus in the ball 134, and 133 show the black portion charged in plus. 135 -- high -- it is a liquid [ \*\*\*\* ]

[0009] the inside of the cavity 131 which one semi-sphere side 132 of this ball 134 is white, has become black [ the semi-sphere side 133 of another side ] in the above-mentioned composition using the ball 134 with this minute display, and formed the aforementioned ball in the base material -- allotting -- the inside of each cavity -- high -- it is filled up with the liquid [ \*\*\*\* ] 135 and a ball 134 enables it to rotate freely in this liquid in this case -- high -- the mutual electrification states of the black of a ball and each white semi-sphere portion differ, rotation can be controlled by the kind of liquid [ \*\*\*\* ] 135 to turn to the side which observes the white or black semi-sphere side of a ball by giving external electric field using 2-dimensional matrix wiring, and the target display can be performed

[0010] Since it is very stable and has memory nature to a temperature change and an electric \*\*\*\* noise, while displaying such the mechanical method of presentation, it does not need power. Furthermore, in order to display using reflection and dispersion of the natural light on the front face of a ball, it is the ideal display which can stop the visus debilitus which happen by flicker of the light source which is seen with liquid crystal equipment and the Braun tube etc.

[0011]

[Problem(s) to be Solved by the Invention] However, as shown in drawing 18 , when producing 2-dimensional matrix wiring, the parallel-pole wiring which intersects perpendicularly is surely needed, and manufacture is serious. Moreover, the bigger problem which says that a manufacturing cost rises while manufacture will become difficult further, if it is going to make a

higher definition display occurred.

[0012] It is being made in order to solve the trouble of this invention and such conventional technology, and applying the principle of electrophotography to display, and aims at offering the display which used the display sheet and it which can operate by the very easy method referred to as exposing printing information to a photosensitive layer instead of. [ matrix wiring ]

[0013] Moreover, this invention is the again more big thing which a higher definition display offers easily, and aims at offering the display which used the display sheet and it which can also cut down a manufacturing cost.

[0014]

[Means for Solving the Problem] Namely, the charge transporting bed to which this invention conveys at least the charge charged from the outside, The charge generating layer which generates a charge by exposure, and the conductive layer charged in a charge, The developer maintenance layer holding the developer colored at least 2 colors which move by this charge, It is the display sheet characterized by having the transparent conductive layer charged in the charge which moves this developer, changing the display of coloring by moving the developer in this developer maintenance layer by the charge, and expressing a picture. As for the aforementioned developer, it is desirable to be charged and to contain the magnetic substance at least in the part among developers.

[0015] Moreover, this invention is display characterized by having the above-mentioned display sheet and the live-part material charged in a display sheet at least, the conveyance member which conveys a display sheet, the development member which develops a display sheet and changes a display, and the exposure member which exposes a display sheet. As for the above-mentioned development member, it is desirable that it is a magnet.

[0016]

[Embodiments of the Invention] The display sheet of this invention is characterized by having the charge transporting bed which conveys the charge charged from the outside at least, the charge generating layer which generates a charge by exposure, the conductive layer charged in a charge, a developer maintenance layer holding the developer which moves by this charge, and the transparent conductive layer charged in the charge to which this developer is moved.

[0017] In this invention, it is applying the principle of electrophotography to display, and the above-mentioned purpose can be attained by the very easy method of telling a photosensitive layer that printing information carries out scanning exposure by laser instead of matrix wiring.

[0018] Moreover, display of this invention is characterized by having the above-mentioned display sheet and the live-part material charged in a display sheet at least, the conveyance member which conveys a display sheet, the development member which develops a display sheet and changes a display, and the exposure member which exposes a display sheet.

[0019] Since the portable display which is not until now can be offered now in this invention, wherever it may be in, required information is available always. Moreover, the postscript close, elimination, and repeat use were completed, and since it was possible to use with the same feeling as a conventional note and conventional paper, display with it has been offered. [ it is user-friendly and friendly to environment ] Since it can moreover colorize, it is effective in the ability to use for a latus use further.

[0020]

[Example] Below, it is attached to the example of \*\*\*\*\* and this invention, and explains to a drawing.

[0021] Example 1 drawing 1 is explanatory drawing showing one example of the display sheet of this invention. As for one, a display sheet and 1-1 are the charge transporting beds in a photosensitive layer 1-9 among drawing. as a material For example, a hydrazone system

compound, a stilbene system compound, a pyrazoline system compound, Charge transportation material and acrylic resin, such as an oxazole system compound, a thiazole system compound, and a triaryl methane system compound, Polyester resin, a polyarylate resin, a polyvinyl chloride resin, polycarbonate resin, Thermoplastics, such as a polyvinyl butyrate resin and a poly methacrylate resin; A polyurethane resin, Binder resins, such as thermosetting resin, such as phenol resin and an epoxy resin, a methanol, Alcohols, such as ethanol, a butanol, and isopropyl alcohol; A methyl ethyl ketone, Ketones, such as an acetone, a methyl isobutyl ketone, and a cyclohexanone; Ethyl acetate, Ester, such as propyl acetate; Hydrocarbons; monochrome chlorobenzene, such as n-hexane, the petroleum ether, and toluene, What applied what was dissolved in the suitable solvent of others, such as halogenated hydrocarbons, such as a dichloromethane, and the thing which added the additive if needed further is mentioned. Moreover, conductive polymer etc. is mentioned.

[0022] 1-2 is a charge generating layer in a photosensitive layer 1-9. as a material For example, azo pigments, such as the Sudan red and crawl DAIAN blue; A copper phthalocyanine, phthalocyanine-pigments [, such as titanylphthalocyanine, ]; -- quinone pigment [, such as ANTO anthrone, ]; -- a perylene pigment -- Charge generating material, such as an indigo pigment, acrylic resin, polyester resin, Thermoplastics, such as polyamide resin, a polyvinyl acetate resin, polycarbonate resin, polyvinyl butyral resin, and a polyvinyl benzal resin; what was distributed to binder resins, such as thermosetting resin, such as a polyurethane resin, phenol resin, and an epoxy resin, is mentioned. It is possible to add an addition agent as occasion demands furthermore.

[0023] A photosensitive layer 1-9 may be the single structure of a layer where the laminated structure which carried out functional separation also contains charge generating material and charge transportation material in the charge generating layer containing charge generating material, and the charge transporting bed containing the amount of charge transportation material.

[0024] 1-3 is the conductive base material of the conductive layer for holding a photosensitive layer. As an example of the quality of the material, the object which carried out mixed molding of conductive metallic oxides, such as metals, such as aluminum, copper, nickel, and silver, or these alloy; antimony oxides, indium oxide, and tin oxide, a carbon fiber, carbon black, and graphite powder and a resin is mentioned. The aluminum sheet was used in this example.

[0025] Furthermore, it is also possible to prepare a conductive layer on a base material for covering of the defect on a base material and protection of a base material. For example, metal-powder objects, such as aluminum, copper, nickel, and silver; An antimony oxide, Conductive metallic oxides, such as indium oxide and tin oxide; Polypyrrole, Macromolecule electrical conducting materials, such as PORIA linin and a polyelectrolyte; A carbon fiber, Carbon black and graphite powder; or such conductive material Acrylic resin, Polyester resin, polyamide resin, a polyvinyl acetate resin, polycarbonate resin, Thermoplastics, such as polyvinyl butyral resin; the object which applied what was distributed to binder resins [, such as a thermosetting resin; photoresist, ], such as a polyurethane resin, phenol resin, and an epoxy resin, and the thing which added add-in material if needed further on the base material is mentioned.

[0026] Moreover, with the charge generating layer of the conductive base material 1-3, you may arrange an insulating layer to an opposite side. If there is this layer when the charge on a toner tends to escape to the conductive base material 1-3, it can prevent escaping and the life of a developer can be prolonged. Furthermore, when the conductive base material 1-3 and the above-mentioned insulating layer are transparent, drawing seen from the position of 6-1 and reversed drawing can be seen from an exposure side.

[0027] 1-4 is an insulation sheet which is the developer maintenance layer which opened many

holes, and has the function to hold the developer (for it to be hereafter described as a toner) with which electrification polarity differs mutually in a hole. The enlarged view of an insulation sheet 1-4 is shown in drawing 2. At this example, the hole opened the 1mmx0.5mm hole with laser in 1.2mm of line writing directions, and 0.7mm pitch of the directions of a train. The size of a hole was decided on the conditions toward which an inner toner does not incline by vibration etc. Moreover, although it is better as thin, the width of face of the rib of the boundary of a hole and a hole is ideal if it can do thinly to toner size and an EQC. The creation method of a hole may be opened by punch besides the above, or you may open it at a time with one drill. Moreover, you may open by etching. The charge of a web material has [ that what is necessary is just insulation ] a polyimide sheet, an acrylic sheet, a polycarbonate sheet, an usable PET sheet, etc. Or the mesh which knit insulating thread is sufficient and you may be a filter-like nonwoven fabric further. Furthermore, although you may be a conductive sheet, it is necessary to perform insulating processing to the portion which touches the electric conduction side 1-3 of the upper and lower sides of a mesh in this case 1-5-1. This insulation sheet is fully equal to practical use, if movement of a toner when a shock is added is not extremely large even if it is a mesh or a nonwoven blanket-like sheet since it aims at making it an inner toner not incline even if a shock is added to some extent from the exterior.

[0028] In drawing 3, 1-5 is a transparent one side electric conduction sheet. 1-5-1 is a transparent insulation sheet, and material used PET in this example. 1-5-2 is a conductive layer, and is a conductive layer which mainly consists of indium oxide in this example. 1-5-2 is always grounded in the gland. In this example, the transparent electric conduction sheet 1-5 used the transparent electric conduction sheet "IDIXO/PET" of Idemitsu Kosan, Inc. If it is made such composition, it is hard to miss the charge of a toner and the screen with high permeability can be obtained. Moreover, as long as 1-5 is transparent, much more electric conduction sheet is sufficient as it. For example, further, when [ from which the charge of a toner cannot escape easily in a transparent electric conduction sheet ] PET, the polycarbonate, and the acrylic board were made to distribute carbon, or when the permeability of a transparent electric conduction sheet is still higher enough, the same display function is obtained.

[0029] 1-6 is the nonmagnetic white toner charged in minus. Size used the thing with a particle size of 5 micrometers. Moreover, 1-7 is the magnetic black toner charged in plus. Size is 10 micrometers in particle size.

[0030] What is necessary is just to choose suitably well-known binding resins for toners, such as polyester resin and styrene acrylic resin, as a kind of binding resin of a toner. What is necessary is just to use one or more material, such as titanium oxide, a zinc oxide, a barium sulfate, an alumina, and a calcium carbonate, as a pigment of the minus nonmagnetic white toner 1-6. Moreover, as for the pigment of the plus magnetism black toner 1-7, carbon black, a copper oxide, manganese dioxide, an aniline black, activated carbon, a nonmagnetic ferrite, a magnetite, etc. are mentioned.

[0031] As these charge control agents, as for example, a right electric charge control agent, a Nigrosine system color, a triphenylmethane-color system color, quarternary ammonium salt, a guanidine derivative, an imidazole derivative, an amine system compound, etc. are mentioned, and a metal-containing salicylic-acid system compound, a metal-containing monoazo color compound, a urea derivative, a styrene-acrylic-acid copolymer, and a styrene-methacrylic-acid copolymer are mentioned as a negative electric charge control agent.

[0032] The creation method of the display sheet 1 is shown using drawing 3. first -- a hole -- adhesives 1-8 are applied to one side of the aperture insulation sheet 1-4 with a roller 7 subsequently, a hole -- the adhesives application side of the aperture insulation sheet 1-4 is put, stuck and united with the insulating side of the transparent electric conduction sheet 1-5 the plus

magnetism black toner 1-7 and the minus nonmagnetic white toner 1-6 which \*\*\*\*\*(ed) enough in the bottle and were firmly charged to the reverse pole mutually in the dry place -- a hole -- it puts in into the aperture insulation sheet 1-4 Adhesives 1-8 are again applied for a toner excessive after that at GOMUHE and others etc. with a roller 7 after grinding \*\*\*\*\*. and the aluminum side of the conductive supporting material 1-3 of an aluminum sheet in which the photosensitive layer was finally formed -- a hole -- the display sheet 1 was produced by carrying and sticking on the field where the adhesives of the aperture insulation sheet 1-4 are applied, and uniting with it Thus, the thickness of the made display sheet 1 is 1mm about.

[0033] Furthermore, in drawing 1 , 2 is an electrification rubber roller for the display sheet 1 being charged, and voltage is impressed from the non-illustrated high voltage power supply. 3 is a magnet roller for development and 4 is a conveyance roller. Material is made of EPDM and urethane which are an insulator, and as shown in drawing, it is in the state of float electrically. The conveyance roller 4 accomplishes the electrification roller 2 and a pair, and conveys the display sheet 1 in the direction of an arrow. 5-1 is a laser beam for writing printing information in the display sheet 1. This may be the light from an LED array. 6-1 shows the position of the view which looks at the visualized information.

[0034] In such composition, the display sheet 1 is first charged in -500V in the front face with the electrification roller 2. At this time, the bias impressed to the electrification roller 2 superimposes the alternating current of 1700V on direct-current-500V at a peak two peak. The display sheet 1 is conveyed by the sense of the arrow in drawing with the electrification roller 2 and the conveyance roller 4.

[0035] It explains in detail using drawing 4 . The plus magnetism black toner 1-7 in the display sheet 1 after passing the electrification roller 2 is moving to the inside bottom of drawing, and the minus nonmagnetic white toner 1-6 is moving to the bottom. This can be explained as follows. That is, the interior of the aluminum sheet 1-3 of a float state is electrically pulled by the charge of minus of the front face of the charge transporting bed 1-1, plus polarizes to the up side and minus polarizes to the down side. And the plus magnetism black toner 1-7 can be drawn near to the charge of this minus by the Coulomb force, and moves to the bottom. Simultaneously, the minus nonmagnetic white toner 1-6 can be drawn near to the charge of the plus which carried out induction from the gland of the grounded transparent conductive layer 1-5-2, and moves to the bottom.

[0036] Next, if the conveyed display sheet 1 comes to an exposure position, the printing information from laser will be written in a front face. Then, a charge generates the place where laser hit in the charge generating layer 1-2, and the charge carries out the discharge of the minus charge of display sheet 1 front face through the charge transporting bed 1-1. Consequently, the charge polarized in the aluminum sheet 1-3 is lost, and the minus charge in the aluminum sheet 1-3 which had drawn the plus magnetism black toner 1-7 also disappears. Simultaneously, the charge which was carrying out induction to the electric conduction side 1-5-2 of the transparent electric conduction sheet 1-5 also returns to a gland, and the force which had pulled the toner on both sides disappears.

[0037] At this time, the plus magnetism black toner 1-7 which became free will be pulled to the bottom by the development magnet roller 3, and the minus nonmagnetic white toner 1-6 will be driven away to the bottom on the contrary. Consequently, since the place where it colored black and laser did not hit is set up so that the force in which it is pulled to the charge charged on the display sheet 1 rather than the force in which it is pulled to a magnet may become large if the place where laser hit is seen from the position by the side of a magnet, the plus magnetism black toner 1-7 does not move, but is still white.

[0038] Moreover, since the pack density of that there is no magnet 3 to which the plus

magnetism black toner 1-7 is moved in the position, and the plus magnetism black toner 1-7 and the minus nonmagnetic white toner 1-6 is optimized even if the charge generating layer 1-2 basks in outdoor daylight 5-2 on the whole surface, generates a charge and carries out the discharge of the charge of display sheet 1 front face after that, there is no movement of a toner and printing information is held as it is. Moreover, since the charge of minus disappears on a photosensitive-layer front face by outdoor daylight, there is also no dust adhering to the charge. [0039] By finally moving the display sheet 1 to the arrow and opposite direction in drawing 1, the position of a toner is reset with a magnet and the plus magnetism black toner 1-7 moves to the bottom. And with the electrification roller 2 with which the display sheet 1 begins movement in the direction of an arrow, and bias is impressed if a new cycle starts, over the whole surface, the plus magnetism black toner 1-7 comes for the bottom to the minus nonmagnetic white toner 1-6, and comes for the bottom to homogeneity. <BR> [0040] Drawing 5 is the perspective diagram of an operation system. The inside 8-1 of drawing is a pen for writing. The string for a pen 8-1 not disappearing, as for 8-2 and 8-3 are the spaces for putting in a pen 8-1. The magnet is attached at the nose of cam, and if the front face of the display sheet 1 is traced now, the plus magnetism black toner 1-8 can draw near, and 8-1 will become a visible image and will appear. "D" is the object which wrote in by making it this appearance among drawing. Moreover, it is also possible to erase the information currently written if it traces with a pen 8-1 from the background of the display sheet 1 conversely.

[0041] The antenna for the keyboard used in case the liquid crystal display section for 9 checking the contents of printing information, a reception place, the destination, etc. and 10 operate it, and 11 receiving the printing information which rode on the electric wave, and 12 show the main part case section. Since it has such composition, the display sheet 1 is repeating a round trip, and can display new printing information on right and left. Moreover, usage which printed on paper can also be done by exchanging for the new display sheet 1, whenever it prepares two or more display sheets 1 and writes in one-sheet information.

[0042] Drawing 6 shows the state where the operation system of drawing 5 was rounded off. Since the display sheet 1 is flexible structure, as shown in drawing, it can be rounded off easily. Consequently, since it can contain compactly, it is not bulky and is convenient to carry.

[0043] Moreover, as shown in drawing 7, it is also possible to fold up the display sheet 1. In this case, this display can become possible [ turning over with Para Para ], and can be used with the same feeling as the usual note.

[0044] The case where wrote in example 2 drawing 8 with the reset process, and a process is made into one process is shown. 2-1 and 2-2 have structure which can carry out a pressure welding to the display sheet 1 by turns with a conductive electrification roller. 4-1 and 4-2 are floating electrically with the insulating conveyance roller.

[0045] In drawing 8, the electrification roller 2-2 is separated from the display sheet 1, and the writing of printing information is performed by the same method as the process explained by drawing 1, and it can check printing information in the position of the eye of 6-1.

[0046] Next, drawing 9 shows signs that printing information is written in simultaneously with reset. The display sheet 1 which has returned in the direction of an arrow of drawing first is charged with the electrification roller 2-2. Since all the plus magnetism black toners 1-7 move to the bottom at this time, the screen of the display sheet 1 is reset at this process.

[0047] Simultaneously, the display sheet 1 is inserted into the electrification roller 2-2 and the conveyance roller 4-2, and is sent in the direction of an arrow. Next, the plus magnetism black toner 1-7 of a portion with which the printing information on laser 5-1 was written in can be drawn near with a magnet 3, and moves to the bottom. Since the electrification roller 2-1 of the point is in a non-contact position to the display sheet 1, a printing pattern arrives at the visual

inspection position of 6-2, without being disturbed in any way.

[0048] By making it such composition, in operation of a round trip of the display sheet 1, printing information can be written in each time and printing speed can be doubled now.

[0049] The 3rd example is shown in example 3 drawing 10. The endless display was attained by making the display sheet 1 into the shape of a loop. 14 is made of a flexible material which is the support plate which supports the display sheet 1 from the inside, and has the waist. The acrylic board with a thickness of 0.5mm was used in this example. Moreover, if a still thinner object is used for a support plate, it is also possible to round off like drawing 6 and to make it compact. There is 13 to the eaves for supporting a support plate 14. Furthermore, a support plate may be in the both sides of not only one side but the main part 12. In this case, the merit which a screen product doubles also comes out.

[0050] The 4th example is shown in example 4 drawing 11. In this example, it is characterized by the ability to rewrite the information on two or more display sheets 1 in a short time. The wire in which 15-1 has spring nature, and 15-2 are KORO made in the acrylic resin for helping sliding of the endless display sheet 1. Drawing 12 is drawing which looked at drawing 11 from the top. Since it has such composition, the display sheet 1 is made in the shape of a spread. Therefore, in the middle class of the usage which suited the use form of a more nearly actual note or a weekly magazine, for example, a no vacancy train, it is effective. Since electrification, exposure, and the development section are furthermore constituted by the outlet of each page, it is especially effective to see comparatively many information in a narrow place for a short time.

[0051] The 5th example is shown in example 5 drawing 13. In this case, since a display page is increased further and it is, it becomes possible to see information with feeling which actually reads a book. Drawing 14 is drawing which looked at drawing 13 from the top. Although electrification, exposure, and the development section are arranged only to the piece place in this example, this is effective in the display of the information which seldom changes, for example, a timetable etc., although there is much amount of information. Moreover, it is not necessary to say that it is effective also in the display of a novel etc.

[0052] The 6th example is shown in example 6 drawing 15. In this example, rotation of the minute ball 1-9 colored the two color is used. As the production method of the minute ball 1-9, it is TiO<sub>2</sub> to a glass ball. High concentration was made to contain, the glass ball was whitened, the vacuum deposition method was used for the semi-sphere side of this white glass ball, and the black layer 1-9-1 of a ferromagnetic was formed. The portion by which vacuum evaporationo is not carried out serves as the white section 1-9-2. Particle size was set to 20 micrometers. Moreover, ferromagnetics, such as iron, nickel, and cobalt, were used as a source of vacuum evaporationo. Moreover, 1-10 is an insulating liquid with transparent high viscosity, such as a silicone oil, and while rotating the minute ball 1-9 smoothly, the sense it was once decided that would be the work holding the charge charged on the minute ball 1-9 also has the maintenance function of the minute ball 1-9 which is not changed in the vibration grade from the outside.

[0053] Using the magnet, electrification to the minute ball 1-9 is in the state turned upward, and corona discharge performed it from the top. Electrification to a reverse pole was similarly performed in the state where the minute ball 1-9 was placed upside down, using the magnet. Then, the silicone oil 1-10 was poured in.

[0054] Since it has the above composition, the charge of the photosensitive layer which the printing information 5-1 hit is extinguished by the charge which generated only the portion from the charge generating layer. Subsequently, the force of holding the minute ball 1-9 is lost, and the black layer 1-9-1 of a ferromagnetic is pulled with a magnet 3. Consequently, the minute ball 1-9 rotates. Therefore, when it sees from the position of 6-1, Leh becomes black and the place where - hit can have it. [ seen ] Furthermore, even if the display sheet 1 advances in the direction

of an arrow and the charge on the front face of a photosensitive layer eliminates by outdoor daylight 5-2, because of what no magnet is in the position, and the silicone oil 1-10 with high viscosity, the sense of the minute ball 1-9 is held, can serve as a memory effect and can hold printing information.

[0055] The 7th example is shown in example 7 drawing 16. In this case, the feature is in the place which used the liquid-development agent for the developer. 1-11 was the black magnetism pigment charged in plus, and the process added Fluorad FC-721 (3 M company make, fluoroiresin) 100g and 10g of cobalt powder of a ferromagnetic metal, and toluene 100g after churning and to this enough with the flasher, and carried out heating churning of the 500g [ of water ], and carbon (mho gal A) (Cabot Corp. make) 100g at 120 degrees C. It cooled after about 4-hour \*\*\*\*, and it ground, after removing volatile matter. The amount of [ 20-50 micrometers and ] water of pigment particle size was 1.2%. 1-12 is the nonmagnetic white resin pigment charged in minus, and is VONCOAT. PP-200S (Dainippon Ink make) were used. Particle size is 0.1-20 micrometers. 1-13 is Isopar G/H.

[0056] To a degree Plus magnetism black pigment 10g Lauryl methacrylate methacrylic-acid copolymer 100g Isopar G/H The mixture which consists of 100g is agitated with a ball mill for 18 hours, and it is the 160g Isopar G/H It dilutes with 1l. and is the white resin pigment VONCOAT. PP-200S [ 50g ] were supplied and agitated and the liquid-development agent was obtained. Moreover, you may add the electric charge control agent of a pigment if needed.

[0057] It explains in detail using drawing 16. The plus magnetism black pigment 1-11 in the display sheet 1 after passing the electrification roller 2 is moving to the inside bottom of drawing, and the minus nonmagnetic white resin pigment 1-12 is moving to the bottom. This can be explained as follows. That is, the interior of the aluminum sheet 1-3 of a float state is electrically pulled by the charge of minus of the front face of the charge transporting bed 1-1, plus polarizes to the up side and minus polarizes to the down side. And the plus magnetism black pigment 1-11 can be drawn near to the charge of this minus by the Coulomb force, and moves to the bottom. Simultaneously, the minus nonmagnetic white resin pigment 1-12 can be drawn near to the charge of the plus which carried out induction from the gland of the grounded transparent conductive layer 1-5, and moves to the bottom.

[0058] Next, if the conveyed display sheet 1 comes to an exposure position, the printing information from laser will be written in a front face. Then, a charge generates the place where laser hit in the charge generating layer 1-2, and the charge carries out the discharge of the minus charge of display sheet 1 front face through the charge transporting bed 1-1. Consequently, the charge polarized in the aluminum sheet 1-3 is lost, and an inside [ of the aluminum sheet 1-3 which had drawn the plus magnetism black pigment 1-11 ], and minus charge also disappears. Simultaneously, the charge which was carrying out induction to the electric conduction side of the transparent electric conduction sheet 1-5 also returns to a gland, and the force which had pulled the toner on both sides disappears.

[0059] At this time, the plus magnetism black pigment 1-11 which became free will be pulled to the bottom by the magnet roller 3 for development, and the minus nonmagnetic white resin pigment 1-12 will be driven away to the bottom on the contrary. Consequently, since the place where it colored black and laser did not hit is set up so that the force in which it is pulled to the charge charged on the display sheet 1 rather than the force in which it is pulled to a magnet may become large if the place where laser hit is seen from the position by the side of a magnet, the plus magnetism black pigment 1-11 is still which is not moved but the minus nonmagnetic white resin pigment 1-12 shows white.

[0060] Moreover, since the pack density of that there is no magnet 3 to which the plus magnetism black pigment 1-11 is moved in the position, and the plus magnetism black pigment

1-11 and the minus nonmagnetic white resin pigment 1-12 is optimized even if the charge generating layer 1-2 basks in outdoor daylight 5-2 on the whole surface, generates a charge and carries out the discharge of the charge of display sheet 1 front face after that, there is no movement of a pigment and printing information is held as it is. Moreover, since the charge of minus disappears on a photosensitive-layer front face by outdoor daylight, there is also no dust adhering to the charge.

[0061] Then, by moving the display sheet 1 to the arrow and opposite direction in drawing 16 , the position of a pigment is reset with a magnet and the plus magnetism black pigment 1-11 moves to the bottom. And with the electrification roller 2 with which the display sheet 1 begins movement in the direction of an arrow, and bias is impressed if a new cycle starts, over the whole surface, the plus magnetism black toner 1-7 comes for the bottom to the minus nonmagnetic white toner 1-6, and comes for the bottom to homogeneity. When the pigment has floated in solvents, such as Isopar, there is a merit of coming to be able to perform movement of a pigment smoothly.

[0062] The example of the octavus is shown in example 8 drawing 17 . The display sheet 1 is colorized in this example. For 1-6, as for a plus magnetism Magenta toner and 1-7-2, a minus nonmagnetic white toner and 1-7-1 are [ a plus magnetism cyanogen toner and 1-7-3 ] plus magnetism yellow toners. As shown in drawing, it is separately put into the toner of three colors in the cell of an insulation sheet 1-4. On the other hand, it is put into the white toner in all cells. A cell size is 600micrometerx300micrometer. toner particle size -- four colors -- a simultaneously -- it is the same and is about 5 micrometers

[0063] What is necessary is just to choose suitably well-known binding resins for toners, such as polyester resin and styrene acrylic resin, as a kind of binding resin of a toner. What is necessary is just to use one or more material, such as titanium oxide, a zinc oxide, a barium sulfate, an alumina, and a calcium carbonate, as a pigment of the minus nonmagnetic white toner 1-6. Moreover, as a pigment of the plus magnetism Magenta toner 1-7-1, a Permanent Red and a Lake Red can use as a pigment of the plus magnetism cyanogen toner 1-7-2, and a copper phthalocyanine blue, INDA Indanthrene blue, and a peacock blue can use Hansa yellow, permanent yellow, a benzidine yellow, etc. widely as a pigment of the plus magnetism yellow toner 1-7-3. Moreover, the \*\* same as these electric charge control agents as the material introduced in the example 1 as a right electric charge control agent is obstructed.

[0064] In the above-mentioned composition, it is irradiating the picture signal corresponding to each cell as a lightwave signal from laser or an LED array, and a color picture can be produced.

[0065]

[Effect of the Invention] As explained above, in this invention, it is applying the principle of electrophotography to display, and it becomes possible to offer the display which can operate by the very easy method referred to as exposing printing information to a photosensitive layer instead of matrix wiring. Moreover, bigger manufacture of a higher definition display can also cut down a manufacturing cost now by the bird clapper easily.

[0066] Since the portable display which is not further until now could be offered now, wherever it might be in, required information became available always. Moreover, the postscript close, elimination, and repeat use were completed, and since it was possible to use with the same feeling as a conventional note and conventional paper, display with it has been offered. [ it is user-friendly and friendly to environment ] Since it can moreover colorize, it is effective in the ability to use for a latus use further.

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TECHNICAL FIELD

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[The technical field to which invention belongs] this invention relates to the display which used a display sheet and it.

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PRIOR ART

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[Description of the Prior Art] In recent years, with development of information machines and equipment, expansion of the amount of data of various information is enhanced, and the informational output is also made with various gestalten. Generally, an informational output can be divided roughly into the display display which used the Braun tube, liquid crystal, etc., and a hard copy display on the paper by the printer etc. In the display display, the needs of the display of a low power and a thin shape are increasing, especially, development active as display which can respond to such needs is performed, and the liquid crystal display is commercialized.

[0003] However, the burden is yet solved fully by the present liquid crystal display neither to the angle which looks at a screen, nor the visual sense which the character on a screen does not look at but is produced from \*\*\*\*, a flicker, low brightness of the light source, etc. by the reflected light. Moreover, in the display display using the Braun tube, neither contrast nor brightness can say enough that there is sufficient display grace as compared with the hard copy display which a flicker of a certain thing generates and etc.-mentions later as compared with a liquid crystal display. Moreover, since equipment is large and heavy, portability is a low very much.

[0004] On the other hand, although it was thought that a hard copy display became unnecessary by informational electronic processing, the hard copy output of an amount huge actual still is performed. In addition to the trouble concerning the display grace mentioned above as the reason when the information was indicated by the display, generally the resolution is also measured with about 120 dpi and the print-out (usually 300 or more dpi) to paper at the maximum, and it is a considerable low. Therefore, in a display display, the burden to a visual sense becomes large as compared with a hard copy display. Consequently, even if a check is possible on a display, once carrying out a hard copy output will often be performed. Moreover, the information by which hard copy was carried out is the big reason a hard copy display is also used together, even if a display display is possible for the ability to rearrange, without performing complicated device operation, or also check [, ] in order, without restricting a viewing area to the size of a display like a display display. [ putting a large number in order ] Furthermore, unless the energy for a hard copy display holding a display is unnecessary and amount of information is extremely large, it has the outstanding portability that it is possible to check information always anywhere.

[0005] Thus, although a hard copy display has different various advantages from a display display unless animation display, frequent rewriting, etc. are required, there is a fault of consuming paper in large quantities. Then, in recent years, development of a lilac ITABURU record medium (record medium with which many times is possible for record / elimination cycle of the high picture of visibility with record medium, and it does not need energy for maintenance of a display) is furthered briskly. The 3rd rewritable means of displaying will be called paper display, inheriting the property which such hard copy has.

[0006] The requirements of a paper display are that it can rewrite, that there is no \*\*\*\* in maintenance of a display about energy, or it is fully small (memory nature), excelling in portability, that display grace is excellent, etc. Now, as means of displaying it can be considered that is a paper display, the reversible display medium using low-molecular [ organic ] and the macromolecule resin matrix unit (for example, JP,55-154198,A, JP,57-82086,A) recorded and eliminated by the thermal printer head can be mentioned, for example. Although a part of this system is used as a part for the display of a prepaid card, contrast's not being so high and the number of times of a repeat of record and elimination have about 150 - 500 times, and technical problems, such as being comparatively few.

[0007] then, the display which used rotation of the minute ball by electric-field drive by N.KSheridon etc. as new display is proposed ("A Twisting Ball Display", Proc.of the SID, volume [ 18th ] No. 3/4, 289-293 pages, 1977, and U.S. JP,4126854,B -- said -- No. 4143103 -- said -- No. 5389945 and JP,64-42683,A)

[0008] The display is shown in drawing 18 -20. The parallel transparent electrode to which in an parallel transparent electrode and 130 a transparent base material and 140 [ a transparent-electrode base material and ] cross at right angles, and 121 and 141 cross [ electrode support with 110 / in drawing 18 , 100 is a display and transparent / a transparent member and 120 ] and 121 / at right angles, and 150 are substrates. Moreover, the cross section of drawing 18 A-A' is drawing 19 . In drawing 19 , 200 shows the bias impressed between a parallel pole 121 and 141. 300 shows the position of an eye by Mukai who looks at a display. Drawing 20 is the elements on larger scale of the transparent base material 130. The mold cavity by which 131 was made into the transparent base material 130, and 134 show the rotating minute ball. The white portion to which 132 was charged in minus in the ball 134, and 133 show the black portion charged in plus. 135 -- high -- it is a liquid [ \*\*\*\* ]

[0009] the inside of the cavity 131 which one semi-sphere side 132 of this ball 134 is white, has become black [ the semi-sphere side 133 of another side ] in the above-mentioned composition using the ball 134 with this minute display, and formed the aforementioned ball in the base material -- allotting -- the inside of each cavity -- high -- it is filled up with the liquid [ \*\*\*\* ] 135 and a ball 134 enables it to rotate freely in this liquid in this case -- high -- the mutual electrification states of the black of a ball and each white semi-sphere portion differ, rotation can be controlled by the kind of liquid [ \*\*\*\* ] 135 to turn to the side which observes the white or black semi-sphere side of a ball by giving external electric field using 2-dimensional matrix wiring, and the target display can be performed

[0010] Since it is very stable and has memory nature to a temperature change and an electric \*\*\*\* noise, while displaying such the mechanical method of presentation, it does not need power. Furthermore, in order to display using reflection and dispersion of the natural light on the front face of a ball, it is the ideal display which can stop the visus debilitus which happen by flicker of the light source which is seen with liquid crystal equipment and the Braun tube etc.

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## **EFFECT OF THE INVENTION**

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**[Effect of the Invention]** As explained above, in this invention, it is applying the principle of electrophotography to display, and it becomes possible to offer the display which can operate by the very easy method referred to as exposing printing information to a photosensitive layer instead of matrix wiring. Moreover, bigger manufacture of a higher definition display can also cut down a manufacturing cost now by the bird clapper easily.

[0066] Since the portable display which is not further until now could be offered now, wherever it might be in, required information became available always. Moreover, the postscript close, elimination, and repeat use were completed, and since it was possible to use with the same feeling as a conventional note and conventional paper, display with it has been offered. [ it is user-friendly and friendly to environment ] Since it can moreover colorize, it is effective in the ability to use for a still larger use.

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## TECHNICAL PROBLEM

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[Problem(s) to be Solved by the Invention] However, as shown in drawing 18 , when producing 2-dimensional matrix wiring, the parallel-pole wiring which intersects perpendicularly is surely needed, and manufacture is serious. Moreover, the bigger problem which says that a manufacturing cost rises while manufacture will become difficult further, if it is going to make a higher definition display occurred.

[0012] It is being made in order to solve the trouble of this invention and such conventional technology, and applying the principle of electrophotography to display, and aims at offering the display which used the display sheet and it which can operate by the very easy method referred to as exposing printing information to a photosensitive layer instead of. [ matrix wiring ]

[0013] Moreover, this invention is the again more big thing which a higher definition display offers easily, and aims at offering the display which used the display sheet and it which can also cut down a manufacturing cost.

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MEANS

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[Means for Solving the Problem] Namely, the charge transporting bed to which this invention conveys at least the charge charged from the outside, The charge generating layer which generates a charge by exposure, and the conductive layer charged in a charge, The developer maintenance layer holding the developer colored at least 2 colors which move by this charge, It is the display sheet characterized by having the transparent conductive layer charged in the charge which moves this developer, changing the display of coloring by moving the developer in this developer maintenance layer by the charge, and expressing a picture. As for the aforementioned developer, it is desirable to be charged and to contain the magnetic substance at least in the part among developers.

[0015] Moreover, this invention is display characterized by having the above-mentioned display sheet and the live-part material charged in a display sheet at least, the conveyance member which conveys a display sheet, the development member which develops a display sheet and changes a display, and the exposure member which exposes a display sheet. As for the above-mentioned development member, it is desirable that it is a magnet.

[0016]

[Embodiments of the Invention] The display sheet of this invention is characterized by having the charge transporting bed which conveys the charge charged from the outside at least, the charge generating layer which generates a charge by exposure, the conductive layer charged in a charge, a developer maintenance layer holding the developer which moves by this charge, and the transparent conductive layer charged in the charge to which this developer is moved.

[0017] In this invention, it is applying the principle of electrophotography to display, and the above-mentioned purpose can be attained by the very easy method of telling a photosensitive layer that printing information carries out scanning exposure by laser instead of matrix wiring.

[0018] Moreover, display of this invention is characterized by having the above-mentioned display sheet and the live-part material charged in a display sheet at least, the conveyance member which conveys a display sheet, the development member which develops a display sheet and changes a display, and the exposure member which exposes a display sheet.

[0019] Since the portable display which is not until now can be offered now in this invention, wherever it may be in, required information is available always. Moreover, the postscript close, elimination, and repeat use were completed, and since it was possible to use with the same feeling as a conventional note and conventional paper, display with it has been offered. [ it is user-friendly and friendly to environment ] Since it can moreover colorize, it is effective in the ability to use for a latus use further.

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[Translation done.]

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EXAMPLE

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[Example] Below, it is attached to the example of \*\*\*\*\* and this invention, and explains to a drawing.

[0021] Example 1 drawing 1 is explanatory drawing showing one example of the display sheet of this invention. As for one, a display sheet and 1-1 are the charge transporting beds in a photosensitive layer 1-9 among drawing. as a material For example, a hydrazone system compound, a stilbene system compound, a pyrazoline system compound, Charge transportation material and acrylic resin, such as an oxazole system compound, a thiazole system compound, and a triaryl methane system compound, Polyester resin, a polyarylate resin, a polyvinyl chloride resin, polycarbonate resin, Thermoplastics, such as a polyvinyl butyrate resin and a poly methacrylate resin; A polyurethane resin, Binder resins, such as thermosetting resin, such as phenol resin and an epoxy resin, a methanol, Alcohols, such as ethanol, a butanol, and isopropyl alcohol; A methyl ethyl ketone, Ketones, such as an acetone, a methyl isobutyl ketone, and a cyclohexanone; Ethyl acetate, Ester, such as propyl acetate; Hydrocarbons; monochrome chlorobenzene, such as n-hexane, the petroleum ether, and toluene, What applied what was dissolved in the suitable solvent of others, such as halogenated hydrocarbons, such as a dichloromethane, and the thing which added the additive if needed further is mentioned.

Moreover, conductive polymer etc. is mentioned.

[0022] 1-2 is a charge generating layer in a photosensitive layer 1-9. as a material For example, azo pigments, such as the Sudan red and crawl DAIAN blue; A copper phthalocyanine, phthalocyanine-pigments [, such as titanylphthalocyanine, ]; -- quinone pigment [, such as ANTO anthrone, ]; -- a perylene pigment -- Charge generating material, such as an indigo pigment, acrylic resin, polyester resin, Thermoplastics, such as polyamide resin, a polyvinyl acetate resin, polycarbonate resin, polyvinyl butyral resin, and a polyvinyl benzal resin; what was distributed to binder resins, such as thermosetting resin, such as a polyurethane resin, phenol resin, and an epoxy resin, is mentioned. It is possible to add an addition agent as occasion demands furthermore.

[0023] A photosensitive layer 1-9 may be the single structure of a layer where the laminated structure which carried out functional separation also contains charge generating material and charge transportation material in the charge generating layer containing charge generating material, and the charge transporting bed containing the amount of charge transportation material.

[0024] 1-3 is the conductive base material of the conductive layer for holding a photosensitive layer. As an example of the quality of the material, the object which carried out mixed molding of conductive metallic oxides, such as metals, such as aluminum, copper, nickel, and silver, or these alloy; antimony oxides, indium oxide, and tin oxide, a carbon fiber, carbon black, and

graphite powder and a resin is mentioned. The aluminum sheet was used in this example. [0025] Furthermore, it is also possible to prepare a conductive layer on a base material for covering of the defect on a base material and protection of a base material. For example, metal-powder objects, such as aluminum, copper, nickel, and silver; An antimony oxide, Conductive metallic oxides, such as indium oxide and tin oxide; Polypyrrole, Macromolecule electrical conducting materials, such as PORIA linin and a polyelectrolyte; A carbon fiber, Carbon black and graphite powder; or such conductive material Acrylic resin, Polyester resin, polyamide resin, a polyvinyl acetate resin, polycarbonate resin, Thermoplastics, such as polyvinyl butyral resin; the object which applied what was distributed to binder resins [, such as a thermosetting resin; photoresist, ], such as a polyurethane resin, phenol resin, and an epoxy resin, and the thing which added add-in material if needed further on the base material is mentioned.

[0026] Moreover, with the charge generating layer of the conductive base material 1-3, you may arrange an insulating layer to an opposite side. If there is this layer when the charge on a toner tends to escape to the conductive base material 1-3, it can prevent escaping and the life of a developer can be prolonged. Furthermore, when the conductive base material 1-3 and the above-mentioned insulating layer are transparent, drawing seen from the position of 6-1 and reversed drawing can be seen from an exposure side.

[0027] 1-4 is an insulation sheet which is the developer maintenance layer which opened many holes, and has the function to hold the developer (for it to be hereafter described as a toner) with which electrification polarity differs mutually in a hole. The enlarged view of an insulation sheet 1-4 is shown in drawing 2 . At this example, the hole opened the 1mmx0.5mm hole with laser in 1.2mm of line writing directions, and 0.7mm pitch of the directions of a train. The size of a hole was decided on the conditions toward which an inner toner does not incline by vibration etc. Moreover, although it is better as thin, the width of face of the rib of the boundary of a hole and a hole is ideal if it can do thinly to toner size and an EQC. The creation method of a hole may be opened by punch besides the above, or you may open it at a time with one drill. Moreover, you may open by etching. The charge of a web material has [ that what is necessary is just insulation ] a polyimide sheet, an acrylic sheet, a polycarbonate sheet, an usable PET sheet, etc. Or the mesh which knit insulating thread is sufficient and you may be a filter-like nonwoven fabric further. Furthermore, although you may be a conductive sheet, it is necessary to perform insulating processing to the portion which touches the electric conduction side 1-3 of the upper and lower sides of a mesh in this case 1-5-1. This insulation sheet is fully equal to practical use, if movement of a toner when a shock is added is not extremely large even if it is a mesh or a nonwoven blanket-like sheet since it aims at making it an inner toner not incline even if a shock is added to some extent from the exterior.

[0028] In drawing 3 , 1-5 is a transparent one side electric conduction sheet. 1-5-1 is a transparent insulation sheet, and material used PET in this example. 1-5-2 is a conductive layer, and is a conductive layer which mainly consists of indium oxide in this example. 1-5-2 is always grounded in the gland. In this example, the transparent electric conduction sheet 1-5 used the transparent electric conduction sheet "IDIXO/PET" of Idemitsu Kosan, Inc. If it is made such composition, it is hard to miss the charge of a toner and the screen with high permeability can be obtained. Moreover, as long as 1-5 is transparent, much more electric conduction sheet is sufficient as it. For example, further, when [ from which the charge of a toner cannot escape easily in a transparent electric conduction sheet ] PET, the polycarbonate, and the acrylic board were made to distribute carbon, or when the permeability of a transparent electric conduction sheet is still higher enough, the same display function is obtained.

[0029] 1-6 is the nonmagnetic white toner charged in minus. Size used the thing with a particle size of 5 micrometers. Moreover, 1-7 is the magnetic black toner charged in plus. Size is 10

micrometers in particle size.

[0030] What is necessary is just to choose suitably well-known binding resins for toners, such as polyester resin and styrene acrylic resin, as a kind of binding resin of a toner. What is necessary is just to use one or more material, such as titanium oxide, a zinc oxide, a barium sulfate, an alumina, and a calcium carbonate, as a pigment of the minus nonmagnetic white toner 1-6. Moreover, as for the pigment of the plus magnetism black toner 1-7, carbon black, a copper oxide, manganese dioxide, an aniline black, activated carbon, a nonmagnetic ferrite, a magnetite, etc. are mentioned.

[0031] As these charge control agents, as for example, a right electric charge control agent, a Nigrosine system color, a triphenylmethane-color system color, quarternary ammonium salt, a guanidine derivative, an imidazole derivative, an amine system compound, etc. are mentioned, and a metal-containing salicylic-acid system compound, a metal-containing monoazo color compound, a urea derivative, a styrene-acrylic-acid copolymer, and a styrene-methacrylic-acid copolymer are mentioned as a negative electric charge control agent.

[0032] The creation method of the display sheet 1 is shown using drawing 3. first -- a hole -- adhesives 1-8 are applied to one side of the aperture insulation sheet 1-4 with a roller 7 subsequently, a hole -- the adhesives application side of the aperture insulation sheet 1-4 is put, stuck and united with the insulating side of the transparent electric conduction sheet 1-5 the plus magnetism black toner 1-7 and the minus nonmagnetic white toner 1-6 which \*\*\*\*(ed) enough in the bottle and were firmly charged to the reverse pole mutually in the dry place -- a hole -- it puts in into the aperture insulation sheet 1-4 Adhesives 1-8 are again applied for a toner excessive after that at GOMUHE and others etc. with a roller 7 after grinding \*\*\*\*\*. and the aluminum side of the conductive supporting material 1-3 of an aluminum sheet in which the photosensitive layer was finally formed -- a hole -- the display sheet 1 was produced by carrying and sticking on the field where the adhesives of the aperture insulation sheet 1-4 are applied, and uniting with it Thus, the thickness of the made display sheet 1 is 1mm about.

[0033] Furthermore, in drawing 1, 2 is an electrification rubber roller for the display sheet 1 being charged, and voltage is impressed from the non-illustrated high voltage power supply. 3 is a magnet roller for development and 4 is a conveyance roller. Material is made of EPDM and urethane which are an insulator, and as shown in drawing, it is in the state of float electrically. The conveyance roller 4 accomplishes the electrification roller 2 and a pair, and conveys the display sheet 1 in the direction of an arrow. 5-1 is a laser beam for writing printing information in the display sheet 1. This may be the light from an LED array. 6-1 shows the position of the view which looks at the visualized information.

[0034] In such composition, the display sheet 1 is first charged in -500V in the front face with the electrification roller 2. At this time, the bias impressed to the electrification roller 2 superimposes the alternating current of 1700V on direct-current-500V at a peak two peak. The display sheet 1 is conveyed by the sense of the arrow in drawing with the electrification roller 2 and the conveyance roller 4.

[0035] It explains in detail using drawing 4. The plus magnetism black toner 1-7 in the display sheet 1 after passing the electrification roller 2 is moving to the inside bottom of drawing, and the minus nonmagnetic white toner 1-6 is moving to the bottom. This can be explained as follows. That is, the interior of the aluminum sheet 1-3 of a float state is electrically pulled by the charge of minus of the front face of the charge transporting bed 1-1, plus polarizes to the up side and minus polarizes to the down side. And the plus magnetism black toner 1-7 can be drawn near to the charge of this minus by the Coulomb force, and moves to the bottom. Simultaneously, the minus nonmagnetic white toner 1-6 can be drawn near to the charge of the plus which carried out induction from the gland of the grounded transparent conductive layer 1-5-2, and moves to the

bottom.

[0036] Next, if the conveyed display sheet 1 comes to an exposure position, the printing information from laser will be written in a front face. Then, a charge generates the place where laser hit in the charge generating layer 1-2, and the charge carries out the discharge of the minus charge of display sheet 1 front face through the charge transporting bed 1-1. Consequently, the charge polarized in the aluminum sheet 1-3 is lost, and the minus charge in the aluminum sheet 1-3 which had drawn the plus magnetism black toner 1-7 also disappears. Simultaneously, the charge which was carrying out induction to the electric conduction side 1-5-2 of the transparent electric conduction sheet 1-5 also returns to a gland, and the force which had pulled the toner on both sides disappears.

[0037] At this time, the plus magnetism black toner 1-7 which became free will be pulled to the bottom by the development magnet roller 3, and the minus nonmagnetic white toner 1-6 will be driven away to the bottom on the contrary. Consequently, since the place where it colored black and laser did not hit is set up so that the force in which it is pulled to the charge charged on the display sheet 1 rather than the force in which it is pulled to a magnet may become large if the place where laser hit is seen from the position by the side of a magnet, the plus magnetism black toner 1-7 does not move, but is still white.

[0038] Moreover, since the pack density of that there is no magnet 3 to which the plus magnetism black toner 1-7 is moved in the position, and the plus magnetism black toner 1-7 and the minus nonmagnetic white toner 1-6 is optimized even if the charge generating layer 1-2 basks in outdoor daylight 5-2 on the whole surface, generates a charge and carries out the discharge of the charge of display sheet 1 front face after that, there is no movement of a toner and printing information is held as it is. Moreover, since the charge of minus disappears on a photosensitive-layer front face by outdoor daylight, there is also no dust adhering to the charge.

[0039] By finally moving the display sheet 1 to the arrow and opposite direction in drawing 1, the position of a toner is reset with a magnet and the plus magnetism black toner 1-7 moves to the bottom. And with the electrification roller 2 with which the display sheet 1 begins movement in the direction of an arrow, and bias is impressed if a new cycle starts, over the whole surface, the plus magnetism black toner 1-7 comes for the bottom to the minus nonmagnetic white toner 1-6, and comes for the bottom to homogeneity.

[0040] Drawing 5 is the perspective diagram of an operation system. The inside 8-1 of drawing is a pen for writing. The string for a pen 8-1 not disappearing, as for 8-2 and 8-3 are the spaces for putting in a pen 8-1. The magnet is attached at the nose of cam, and if the front face of the display sheet 1 is traced now, the plus magnetism black toner 1-8 can draw near, and 8-1 will become a visible image and will appear. "D" is the object which wrote in by making it this appearance among drawing. Moreover, it is also possible to erase the information currently written if it traces with a pen 8-1 from the background of the display sheet 1 conversely.

[0041] The antenna for the keyboard used in case the liquid crystal display section for 9 checking the content of printing information, a reception place, the destination, etc. and 10 operate it, and 11 receiving the printing information which rode on the electric wave, and 12 show the main part case section. Since it has such composition, the display sheet 1 is repeating a round trip, and can display new printing information on right and left. Moreover, usage which printed on paper can also be done by exchanging for the new display sheet 1, whenever it prepares two or more display sheets 1 and writes in one-sheet information.

[0042] Drawing 6 shows the state where the operation system of drawing 5 was rounded off. Since the display sheet 1 is flexible structure, as shown in drawing, it can be rounded off easily. Consequently, since it can contain compactly, it is not bulky and is convenient to carry.

[0043] Moreover, as shown in drawing 7, it is also possible to fold up the display sheet 1. In this

case, this display can become possible [ turning over with Para Para ], and can be used with the same feeling as the usual note.

[0044] The case where wrote in example 2 drawing 8 with the reset process, and a process is made into one process is shown. 2-1 and 2-2 have structure which can carry out a pressure welding to the display sheet 1 by turns with a conductive electrification roller. 4-1 and 4-2 are floating electrically with the insulating conveyance roller.

[0045] In drawing 8, the electrification roller 2-2 is separated from the display sheet 1, and the writing of printing information is performed by the same method as the process explained by drawing 1, and it can check printing information in the position of the eye of 6-1.

[0046] Next, drawing 9 shows signs that printing information is written in simultaneously with reset. The display sheet 1 which has returned in the direction of an arrow of drawing first is charged with the electrification roller 2-2. Since all the plus magnetism black toners 1-7 move to the bottom at this time, the screen of the display sheet 1 is reset at this process.

[0047] Simultaneously, the display sheet 1 is inserted into the electrification roller 2-2 and the conveyance roller 4-2, and is sent in the direction of an arrow. Next, the plus magnetism black toner 1-7 of a portion with which the printing information on laser 5-1 was written in can be drawn near with a magnet 3, and moves to the bottom. Since the electrification roller 2-1 of the point is in a non-contact position to the display sheet 1, a printing pattern arrives at the visual inspection position of 6-2, without being disturbed in any way.

[0048] By making it such composition, in operation of a round trip of the display sheet 1, printing information can be written in each time and printing speed can be doubled now.

[0049] The 3rd example is shown in example 3 drawing 10. The endless display was attained by making the display sheet 1 into the shape of a loop. 14 is made of a flexible material which is the support plate which supports the display sheet 1 from the inside, and has the waist. The acrylic board with a thickness of 0.5mm was used in this example. Moreover, if a still thinner object is used for a support plate, it is also possible to round off like drawing 6 and to make it compact. There is 13 to the eaves for supporting a support plate 14. Furthermore, a support plate may be in the both sides of not only one side but the main part 12. In this case, the merit which a screen product doubles also comes out.

[0050] The 4th example is shown in example 4 drawing 11. In this example, it is characterized by the ability to rewrite the information on two or more display sheets 1 in a short time. The wire in which 15-1 has spring nature, and 15-2 are the koro made in the acrylic resin for helping sliding of the endless display sheet 1. Drawing 12 is drawing which looked at drawing 11 from the top. Since it has such composition, the display sheet 1 is made in the shape of a spread. Therefore, in the middle class of the usage which suited the use gestalt of a more nearly actual note or a weekly magazine, for example, a no vacancy train, it is effective. Since electrification, exposure, and the development section are furthermore constituted by the outlet of each page, it is especially effective to see comparatively many information in a narrow place for a short time.

[0051] The 5th example is shown in example 5 drawing 13. In this case, since a display page is increased further and it is, it becomes possible to see information with feeling which actually reads a book. Drawing 14 is drawing which looked at drawing 13 from the top. Although electrification, exposure, and the development section are arranged only to the piece place in this example, this is effective in the display of the information which seldom changes, for example, a timetable etc., although there is much amount of information. Moreover, it is not necessary to say that it is effective also in the display of a novel etc.

[0052] The 6th example is shown in example 6 drawing 15. In this example, rotation of the minute ball 1-9 colored the two color is used. As the production method of the minute ball 1-9, it is TiO<sub>2</sub> to a glass ball. High concentration was made to contain, the glass ball was whitened, the

vacuum deposition method was used for the semi-sphere side of this white glass ball, and the black layer 1-9-1 of a ferromagnetic was formed. The portion by which vacuum evaporationo is not carried out serves as the white section 1-9-2. Particle size was set to 20 micrometers.

Moreover, ferromagnetics, such as iron, nickel, and cobalt, were used as a source of vacuum evaporationo. Moreover, 1-10 is an insulating liquid with transparent high viscosity, such as a silicone oil, and while rotating the minute ball 1-9 smoothly, the sense it was once decided that would be the work holding the charge charged on the minute ball 1-9 also has the maintenance function of the minute ball 1-9 which is not changed in the vibration grade from the outside.

[0053] Using the magnet, electrification to the minute ball 1-9 is in the state turned upward, and corona discharge performed it from the top. Electrification to a reverse pole was similarly performed in the state where the minute ball 1-9 was placed upside down, using the magnet.

Then, the silicone oil 1-10 was poured in.

[0054] Since it has the above composition, the charge of the photosensitive layer which the printing information 5-1 hit is extinguished by the charge which generated only the portion from the charge generating layer. Subsequently, the force of holding the minute ball 1-9 is lost, and the black layer 1-9-1 of a ferromagnetic is pulled with a magnet 3. Consequently, the minute ball 1-9 rotates. Therefore, when it sees from the position of 6-1, Leh becomes black and the place where - hit can have it. [ seen ] Furthermore, even if the display sheet 1 advances in the direction of an arrow and the charge on the front face of a photosensitive layer eliminates by outdoor daylight 5-2, because of what no magnet is in the position, and the silicone oil 1-10 with high viscosity, the sense of the minute ball 1-9 is held, can serve as a memory effect and can hold printing information.

[0055] The 7th example is shown in example 7 drawing 16 . In this case, the feature is in the place which used the liquid-development agent for the developer. 1-11 was the black magnetism pigment charged in plus, and the process added Fluorad FC-721 (3 M company make, fluoroiresin) 100g and 10g of cobalt powder of a ferromagnetic metal, and toluene 100g after churning and to this enough with the flasher, and carried out heating churning of the 500g [ of water ], and carbon (mho gal A) (Cabot Corp. make) 100g at 120 degrees C. It cooled after about 4-hour \*\*\*\*, and it ground, after removing volatile matter. The amount of [ 20-50 micrometers and ] water of pigment particle size was 1.2%. 1-12 is the nonmagnetic white resin pigment charged in minus, and is VONCOAT. PP-200S (Dainippon Ink make) were used. Particle size is 0.1-20 micrometers. 1-13 is Isopar G/H.

[0056] To a degree Plus magnetism black pigment 10g Lauryl methacrylate methacrylic-acid copolymer 100g Isopar G/H The mixture which consists of 100g is agitated with a ball mill for 18 hours, and it is the 160g Isopar G/H It dilutes with 11. and is the white resin pigment VONCOAT. PP-200S [ 50g ] were supplied and agitated and the liquid-development agent was obtained. Moreover, you may add the electric charge control agent of a pigment if needed.

[0057] It explains in detail using drawing 16 . The plus magnetism black pigment 1-11 in the display sheet 1 after passing the electrification roller 2 is moving to the inside bottom of drawing, and the minus nonmagnetic white resin pigment 1-12 is moving to the bottom. This can be explained as follows. That is, the interior of the aluminum sheet 1-3 of a float state is electrically pulled by the charge of minus of the front face of the charge transporting bed 1-1, plus polarizes to the up side and minus polarizes to the down side. And the plus magnetism black pigment 1-11 can be drawn near to the charge of this minus by the Coulomb force, and moves to the bottom. Simultaneously, the minus nonmagnetic white resin pigment 1-12 can be drawn near to the charge of the plus which carried out induction from the gland of the grounded transparent conductive layer 1-5, and moves to the bottom.

[0058] Next, if the conveyed display sheet 1 comes to an exposure position, the printing

information from laser will be written in a front face. Then, a charge generates the place where laser hit in the charge generating layer 1-2, and the charge carries out the discharge of the minus charge of display sheet 1 front face through the charge transporting bed 1-1. Consequently, the charge polarized in the aluminum sheet 1-3 is lost, and an inside [ of the aluminum sheet 1-3 which had drawn the plus magnetism black pigment 1-11 ], and minus charge also disappears. Simultaneously, the charge which was carrying out induction to the electric conduction side of the transparent electric conduction sheet 1-5 also returns to a gland, and the force which had pulled the toner on both sides disappears.

[0059] At this time, the plus magnetism black pigment 1-11 which became free will be pulled to the bottom by the magnet roller 3 for development, and the minus nonmagnetic white resin pigment 1-12 will be driven away to the bottom on the contrary. Consequently, since the place where it colored black and laser did not hit is set up so that the force in which it is pulled to the charge charged on the display sheet 1 rather than the force in which it is pulled to a magnet may become large if the place where laser hit is seen from the position by the side of a magnet, the plus magnetism black pigment 1-11 is still which is not moved but the minus nonmagnetic white resin pigment 1-12 shows white.

[0060] Moreover, since the pack density of that there is no magnet 3 to which the plus magnetism black pigment 1-11 is moved in the position, and the plus magnetism black pigment 1-11 and the minus nonmagnetic white resin pigment 1-12 is optimized even if the charge generating layer 1-2 basks in outdoor daylight 5-2 on the whole surface, generates a charge and carries out the discharge of the charge of display sheet 1 front face after that, there is no movement of a pigment and printing information is held as it is. Moreover, since the charge of minus disappears on a photosensitive-layer front face by outdoor daylight, there is also no dust adhering to the charge.

[0061] Then, by moving the display sheet 1 to the arrow and opposite direction in drawing 16 , the position of a pigment is reset with a magnet and the plus magnetism black pigment 1-11 moves to the bottom. And with the electrification roller 2 with which the display sheet 1 begins movement in the direction of an arrow, and bias is impressed if a new cycle starts, over the whole surface, the plus magnetism black toner 1-7 comes for the bottom to the minus nonmagnetic white toner 1-6, and comes for the bottom to homogeneity. When the pigment has floated in solvents, such as Isopar, there is a merit of coming to be able to perform movement of a pigment smoothly.

[0062] The example of the octavus is shown in example 8 drawing 17 . The display sheet 1 is colorized in this example. For 1-6, as for a plus magnetism Magenta toner and 1-7-2, a minus nonmagnetic white toner and 1-7-1 are [ a plus magnetism cyanogen toner and 1-7-3 ] plus magnetism yellow toners. As shown in drawing, it is separately put into the toner of three colors in the cell of an insulation sheet 1-4. On the other hand, it is put into the white toner in all cells. A cell size is 600micrometerx300micrometer. toner particle size -- four colors -- a simultaneously -- it is the same and is about 5 micrometers

[0063] What is necessary is just to choose suitably well-known binding resins for toners, such as polyester resin and styrene acrylic resin, as a kind of binding resin of a toner. What is necessary is just to use one or more material, such as titanium oxide, a zinc oxide, a barium sulfate, an alumina, and a calcium carbonate, as a pigment of the minus nonmagnetic white toner 1-6. Moreover, as a pigment of the plus magnetism Magenta toner 1-7-1, a Permanent Red and a Lake Red can use as a pigment of the plus magnetism cyanogen toner 1-7-2, and a copper phthalocyanine blue, INDA Indanthrene blue, and a peacock blue can use Hansa yellow, permanent yellow, a benzidine yellow, etc. widely as a pigment of the plus magnetism yellow toner 1-7-3. Moreover, the \*\* same as these electric charge control agents as the material

introduced in the example 1 as a right electric charge control agent is obstructed.

[0064] In the above-mentioned composition, it is irradiating the picture signal corresponding to each cell as a lightwave signal from laser or an LED array, and a color picture can be produced.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1] It is explanatory drawing showing the display sheet of the example 1 of this invention.

[Drawing 2] It is the enlarged view of the insulation sheet of the example 1 of this invention.

[Drawing 3] It is drawing showing the formation process of the display sheet of the example 1 of this invention.

[Drawing 4] It is drawing showing the movement of the charge in the display sheet of the example 1 of this invention.

[Drawing 5] It is drawing showing an example of the product gestalt of the example 1 of this invention.

[Drawing 6] It is partial explanatory drawing of drawing 5 .

[Drawing 7] It is partial explanatory drawing of drawing 5 .

[Drawing 8] It is drawing showing the case where wrote in with the reset process of the example 2 of this invention, and a process is made into one process.

[Drawing 9] It is drawing showing other examples of the process of drawing 8 .

[Drawing 10] It is drawing showing the case where the display sheet of the example 3 of this invention is made into the shape of a loop.

[Drawing 11] It is drawing showing the case where the display sheet of the example 4 of this invention is made into the shape of a spread.

[Drawing 12] It is partial explanatory drawing of drawing 11 .

[Drawing 13] It is drawing showing the case where a display page is increased for the display sheet of the example 5 of this invention like a book.

[Drawing 14] It is partial explanatory drawing of drawing 13 .

[Drawing 15] In the display sheet of the example 6 of this invention, it is drawing showing the minute ball colored the two color.

[Drawing 16] In the display sheet of the example 7 of this invention, it is drawing showing the case where a liquid-development agent is used for a developer.

[Drawing 17] In the display sheet of the example 8 of this invention, it is drawing showing the case of colorization.

[Drawing 18] It is drawing showing the conventional display sheet.

[Drawing 19] It is the cross section of A-A' of drawing 18 .

[Drawing 20] They are the elements on larger scale of the conventional display sheet.

[Description of Notations]

1 Display Sheet

2 Electrification Rubber Roller

3 Magnet Roller for Development  
4 Conveyance Roller  
5 Exposure  
6 Position of Eye  
7 Adhesives Application Roller  
8 Pen  
9 Liquid Crystal Display  
10 Keyboard  
11 Antenna  
12 Main Part  
13 Eaves  
14 Support Plate  
15 Wire  
100 Display  
110 Transparent Member  
120 Electrode Support  
130 Transparent Base Material  
131 Mold Cavity  
132 White Portion  
133 Black Portion  
134 Minute Ball  
135 High Resistance Liquid  
140 Transparent-Electrode Base Material  
150 Substrate  
200 Bias  
300 Position of Eye

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**CLAIMS**

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**[Claim(s)]**

[Claim 1] The charge transporting bed which conveys at least the charge charged from the outside, and the charge generating layer which generates a charge by exposure, The conductive layer charged in a charge, and the developer maintenance layer holding the developer which colored it at least 2 colors which move by this charge, The display sheet characterized by having the transparent conductive layer charged in the charge which moves this developer, changing the display of coloring by moving the developer in this developer maintenance layer by the charge, and expressing a picture.

[Claim 2] The aforementioned developer is an electrified display sheet according to claim 1.

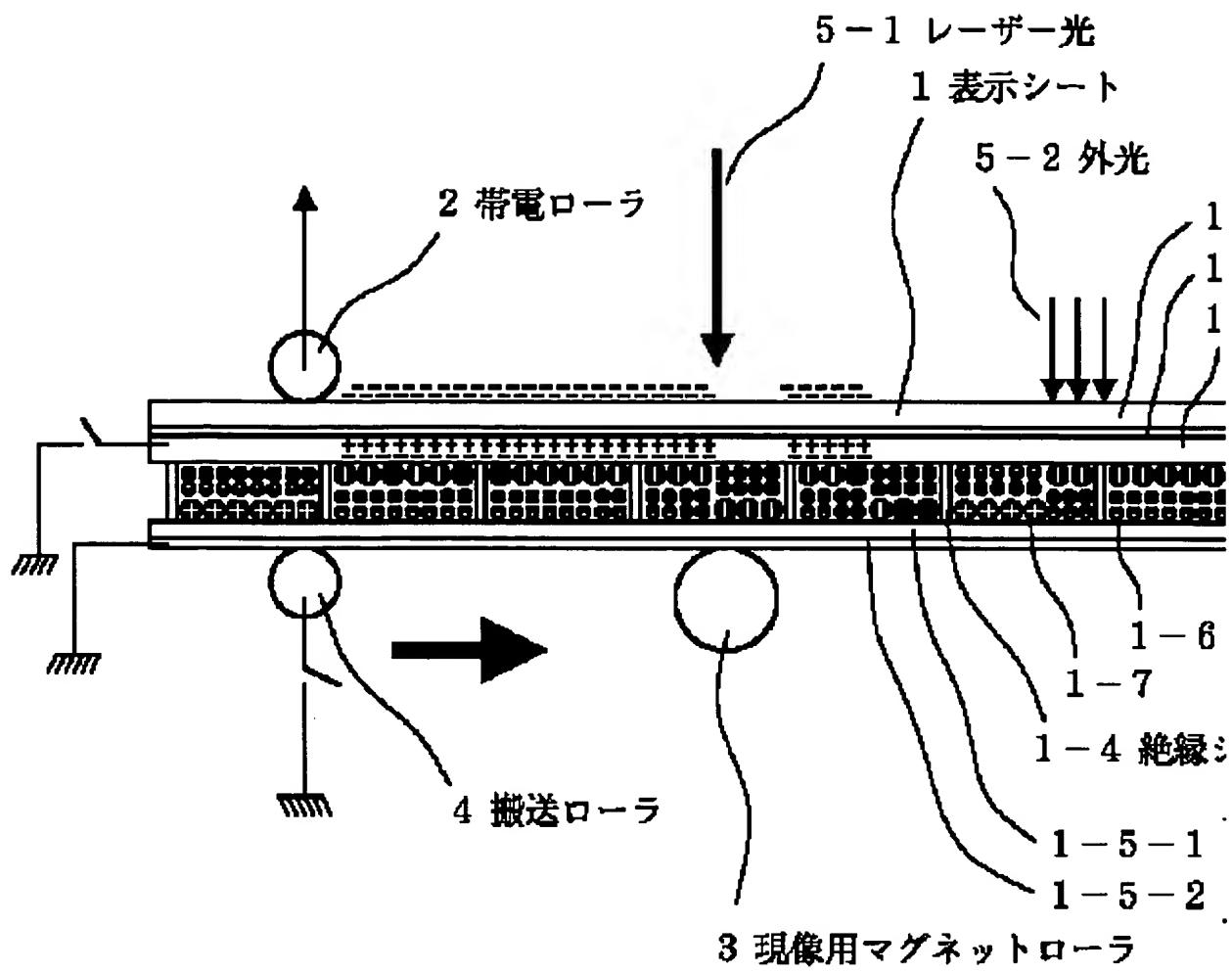
[Claim 3] The display sheet according to claim 1 which contains the magnetic substance at least in the part among the aforementioned developers.

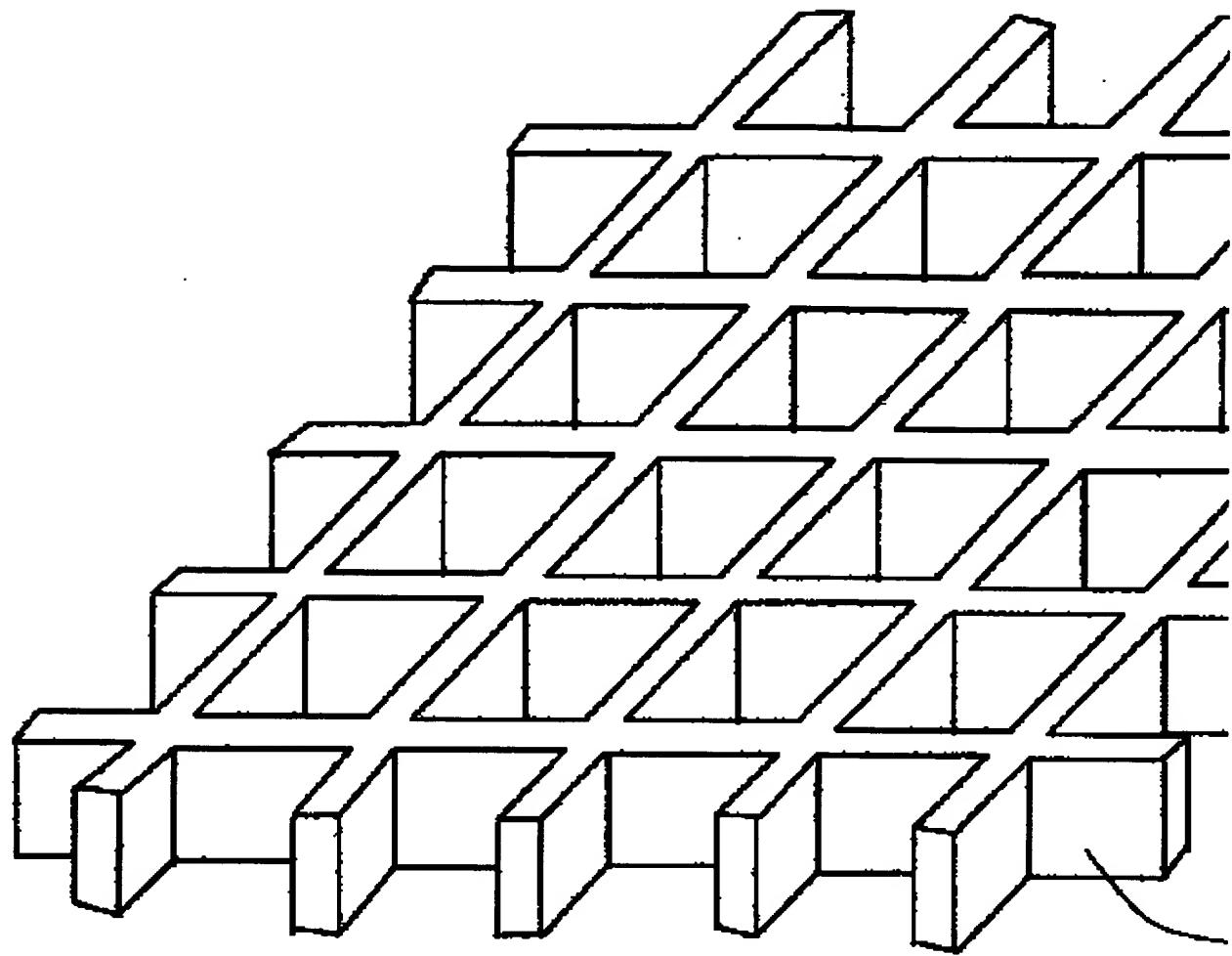
[Claim 4] Display characterized by having a claim 1 or one display sheet of 3 and the live-part material charged in this display sheet at least, the conveyance member which conveys a display sheet, the development member which develops a display sheet and changes a display, and the exposure member which exposes a display sheet.

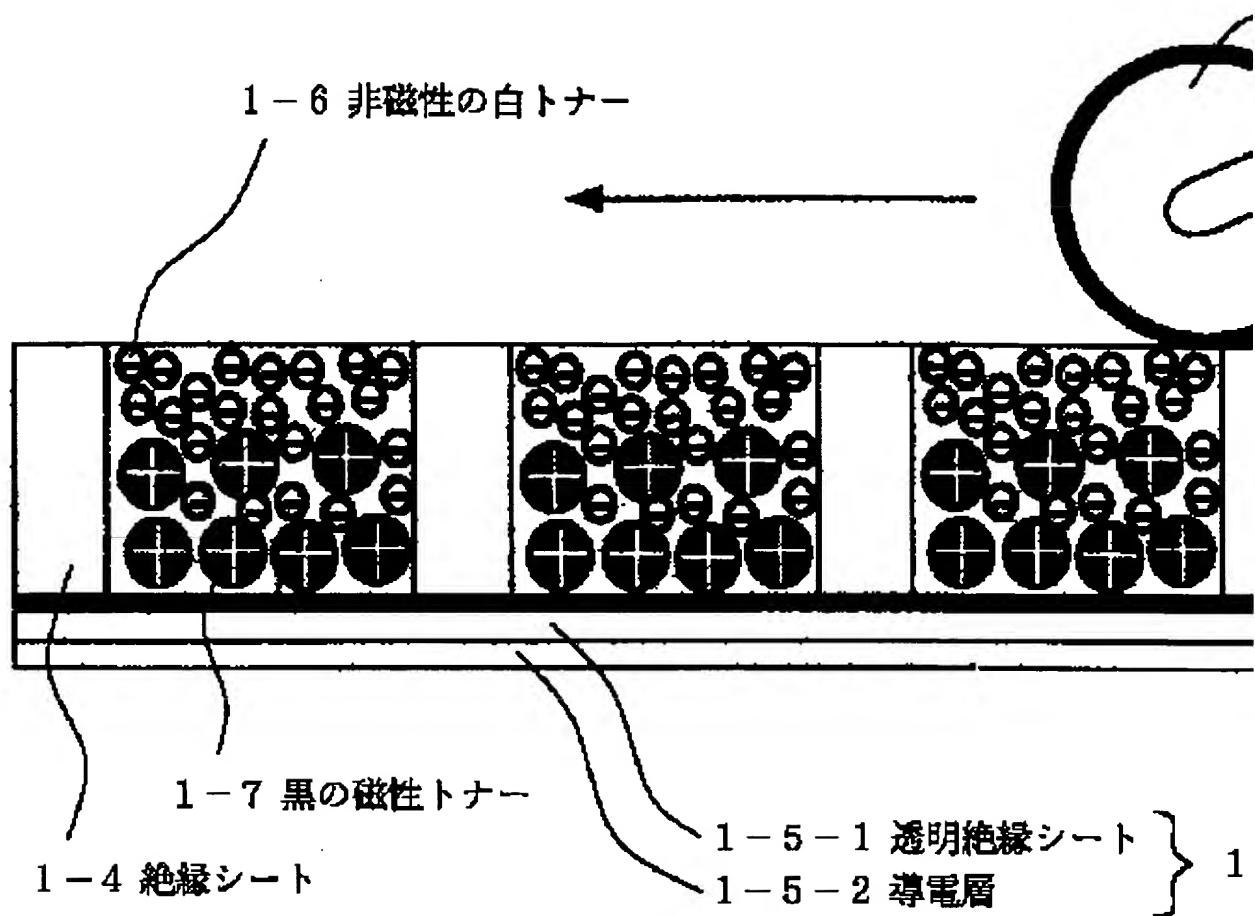
[Claim 5] The above-mentioned development member is a display sheet according to claim 4 which is a magnet.

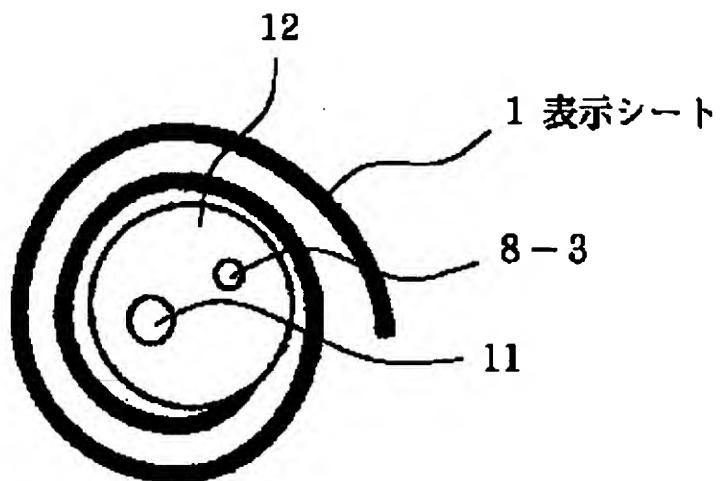
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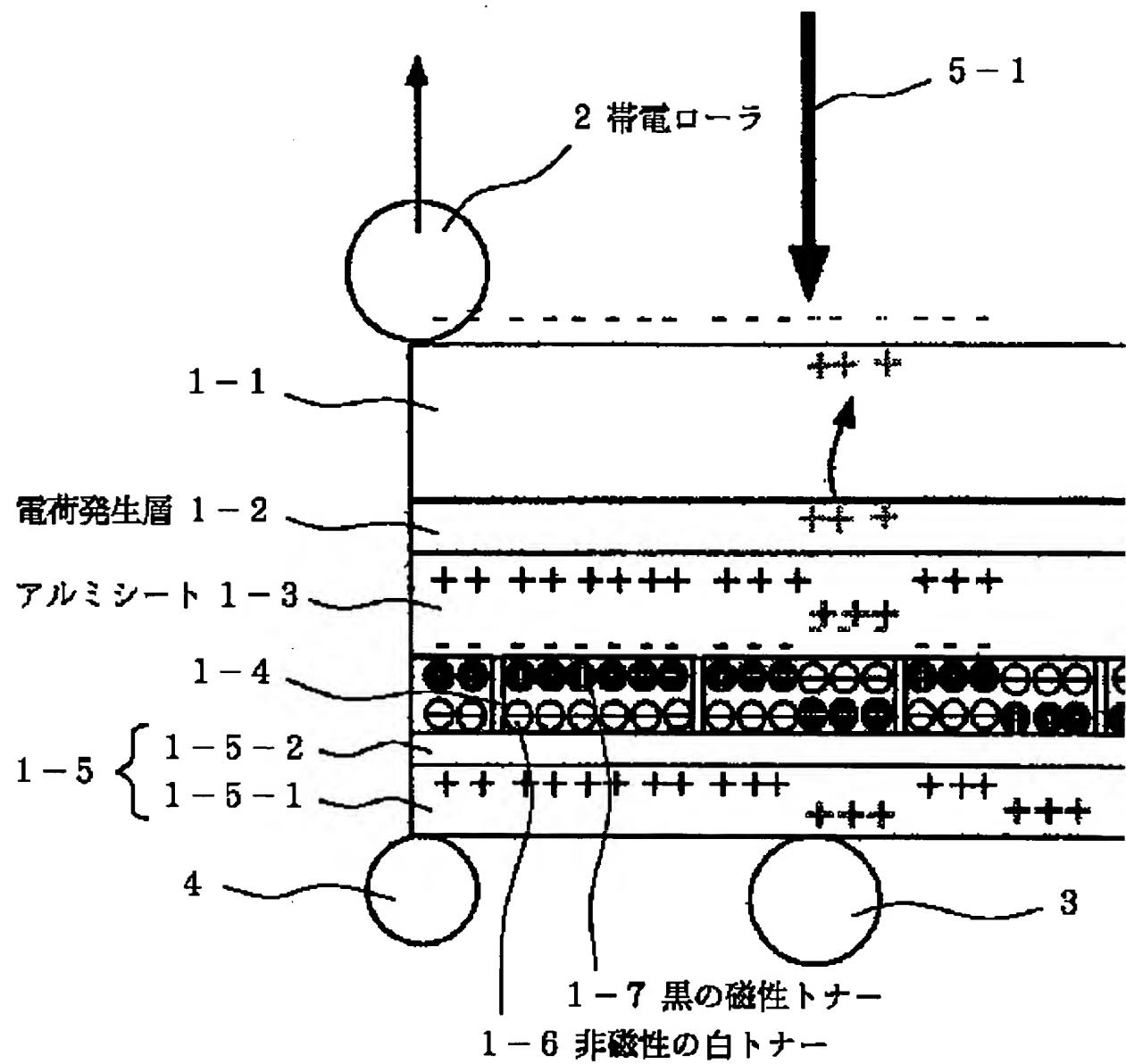
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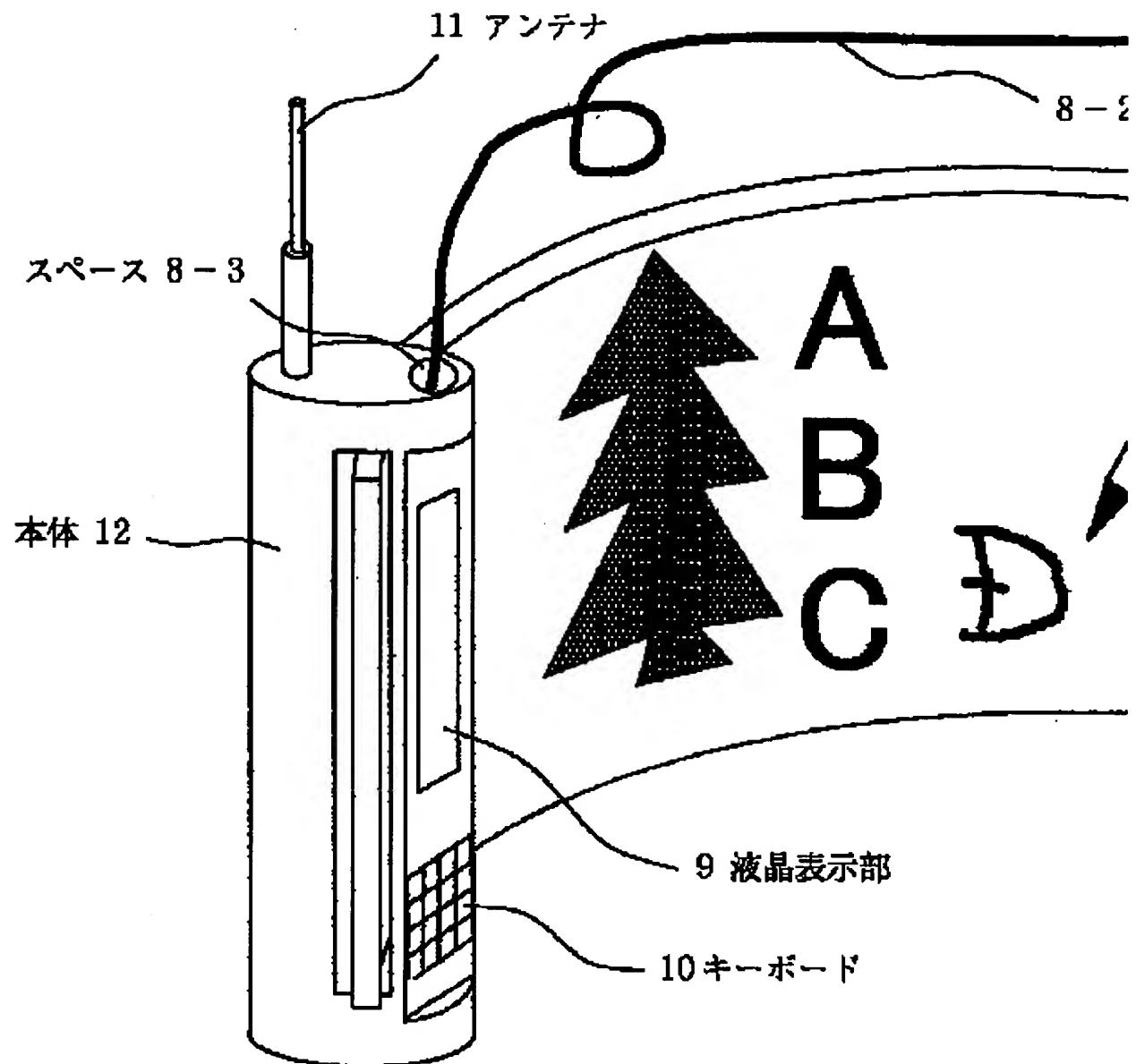












\* NOTICES \*

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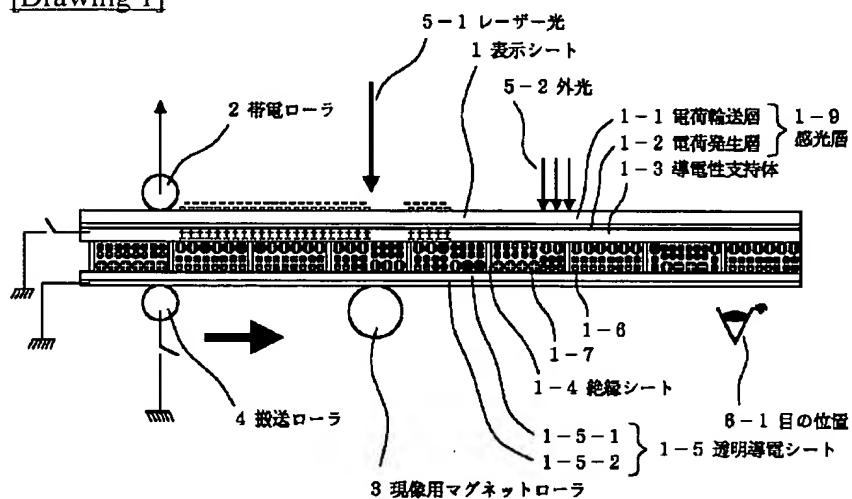
1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

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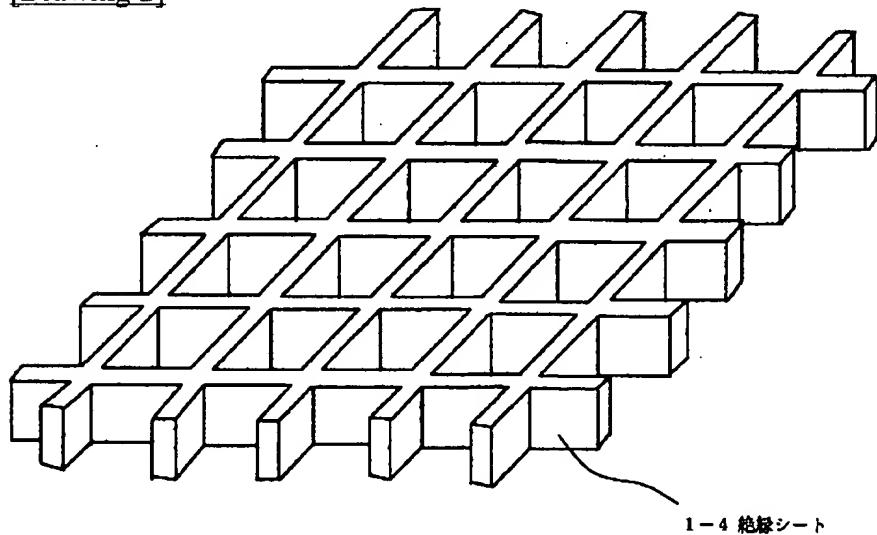
DRAWINGS

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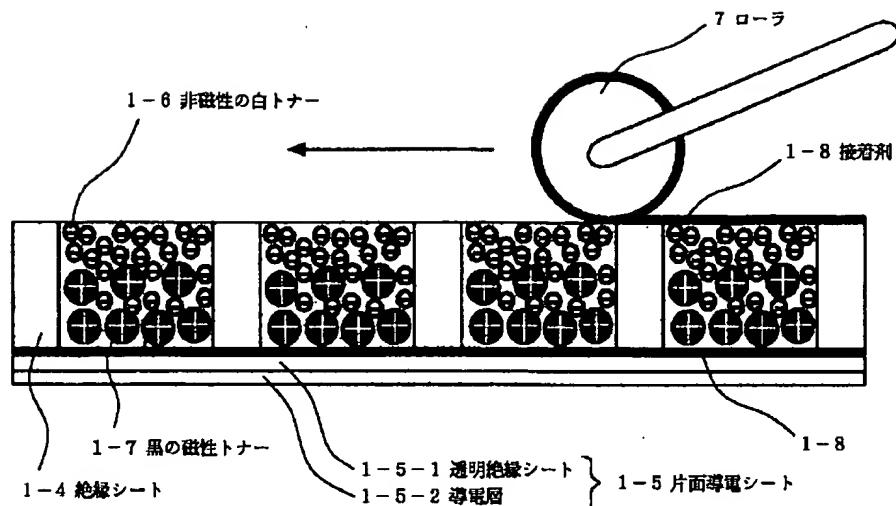
[Drawing 1]



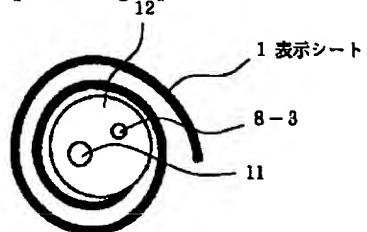
[Drawing 2]



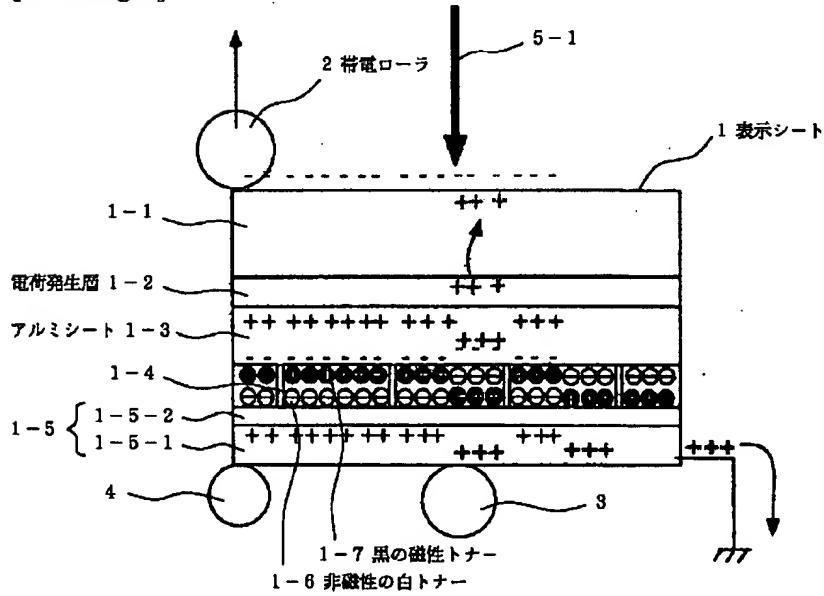
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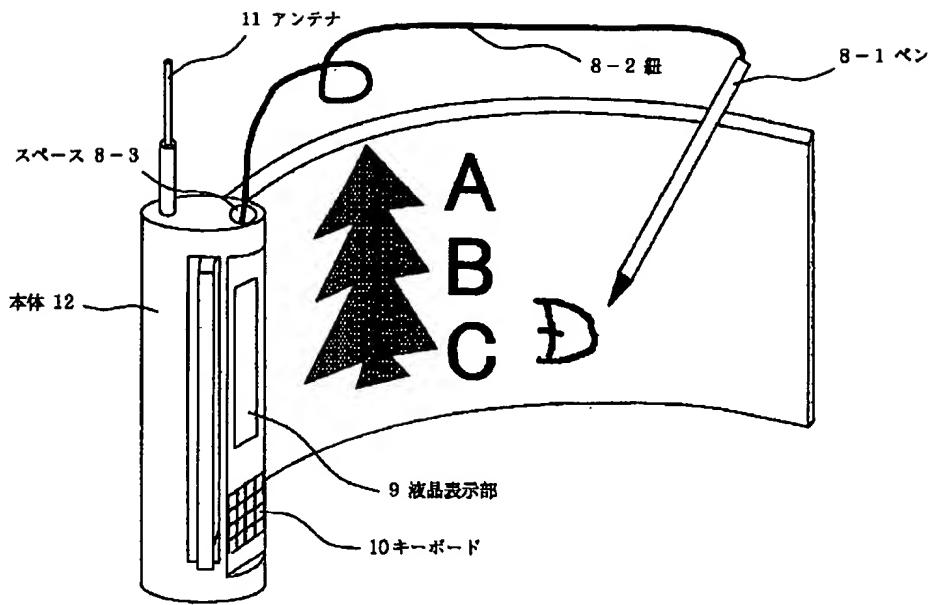
[Drawing 6]



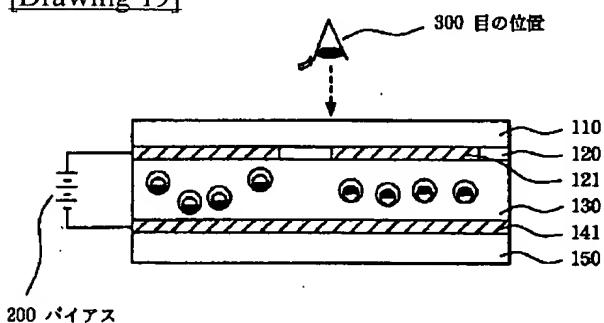
[Drawing 4]



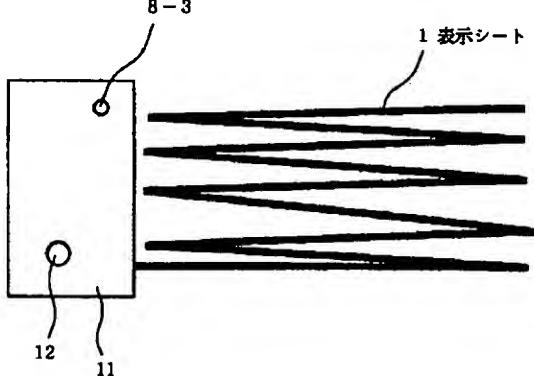
[Drawing 5]



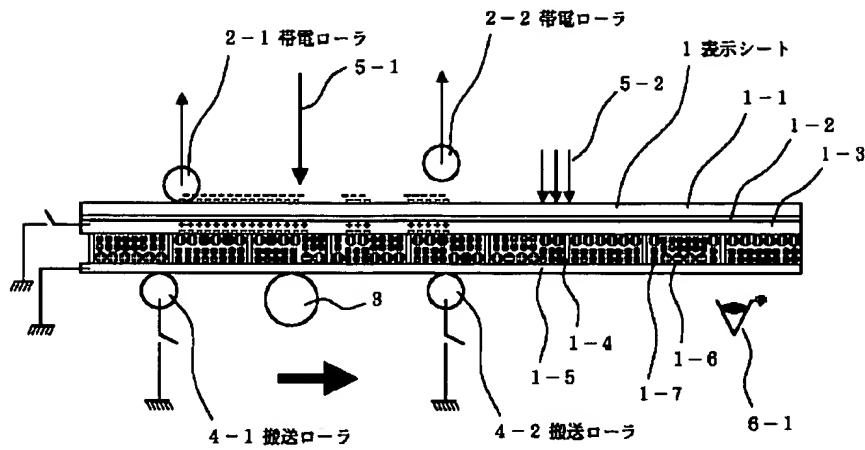
[Drawing 19]



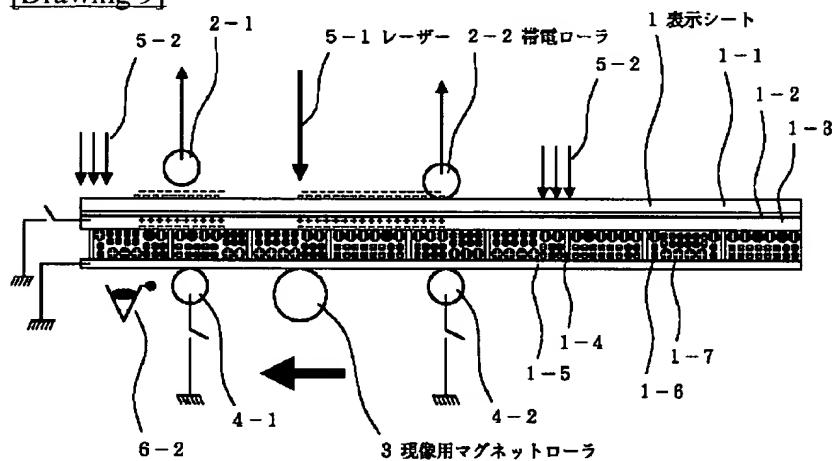
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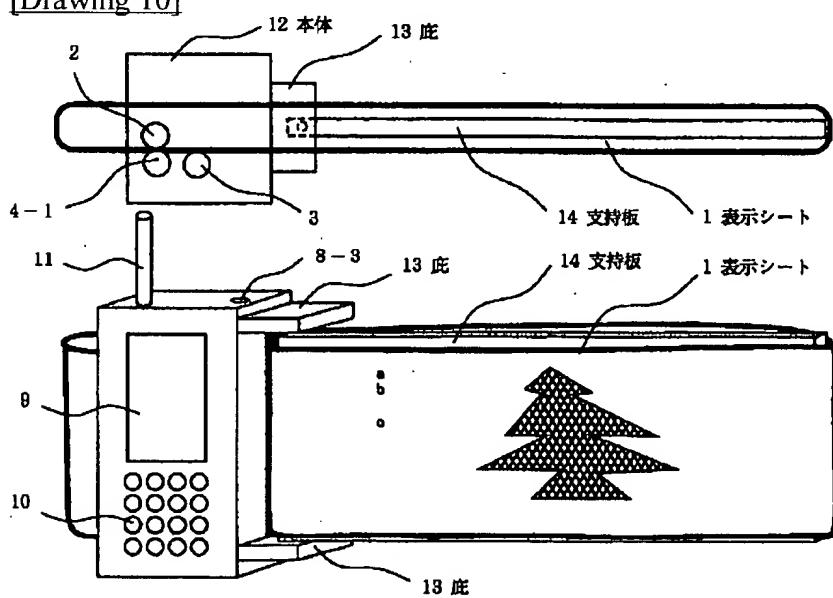
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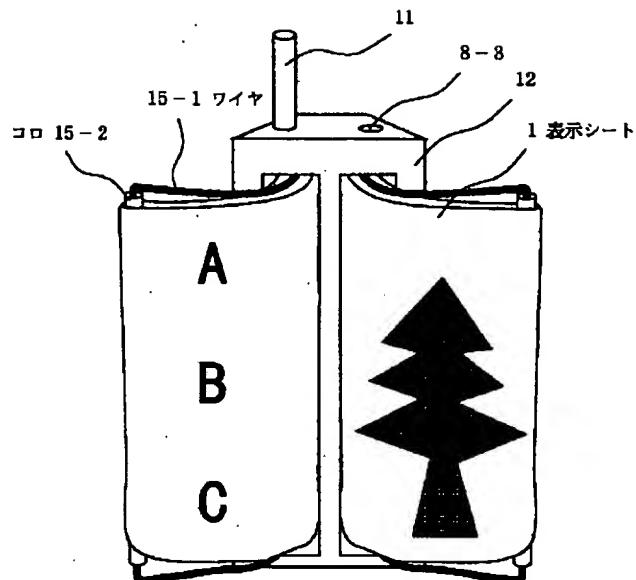
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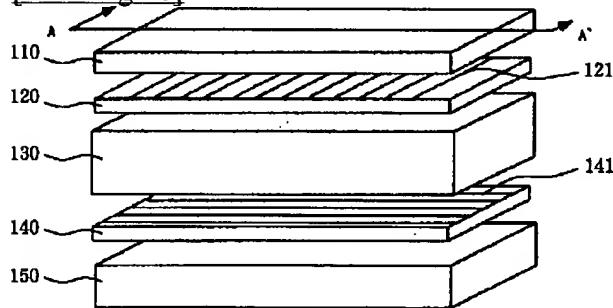
[Drawing 10]



[Drawing 11]

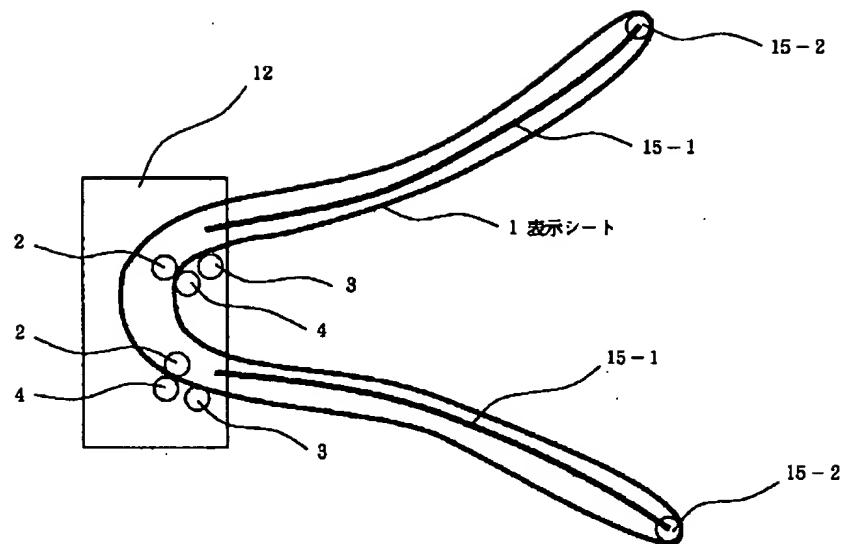


[Drawing 15]

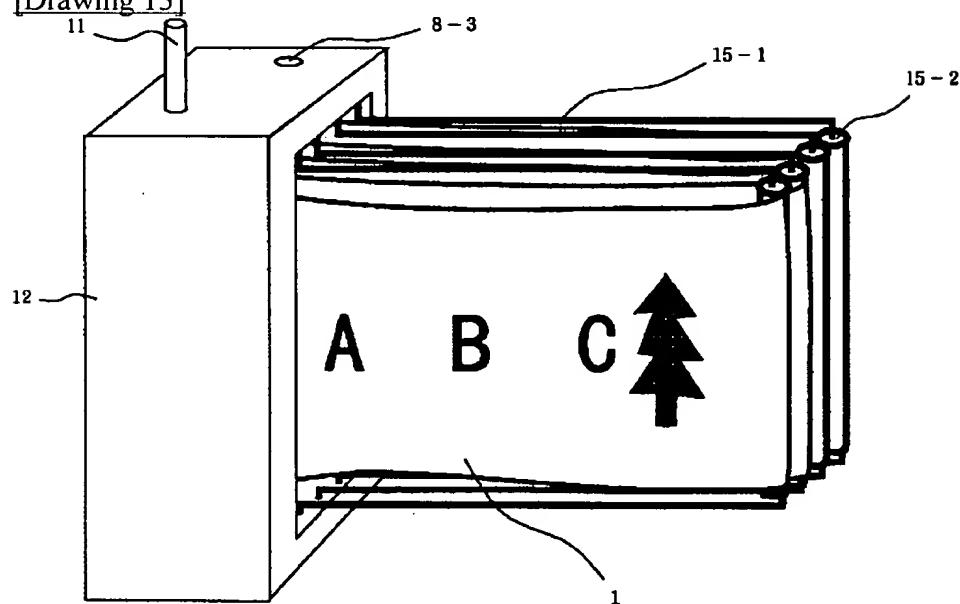


110 透明部材  
 120 電極支持体  
 121 平行透明電極  
 130 透明支持体  
 140 透明電極支持体  
 141 平行透明電極  
 150 基板

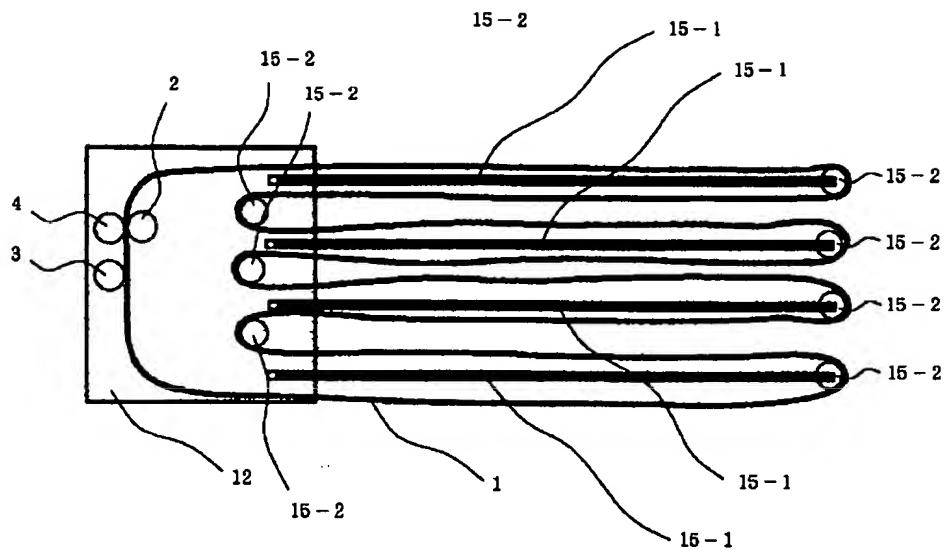
[Drawing 12]



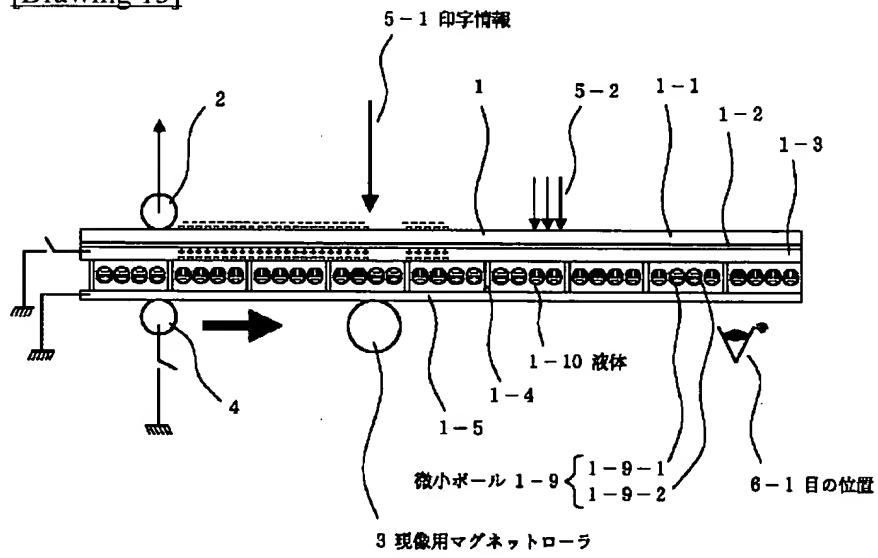
[Drawing 13]



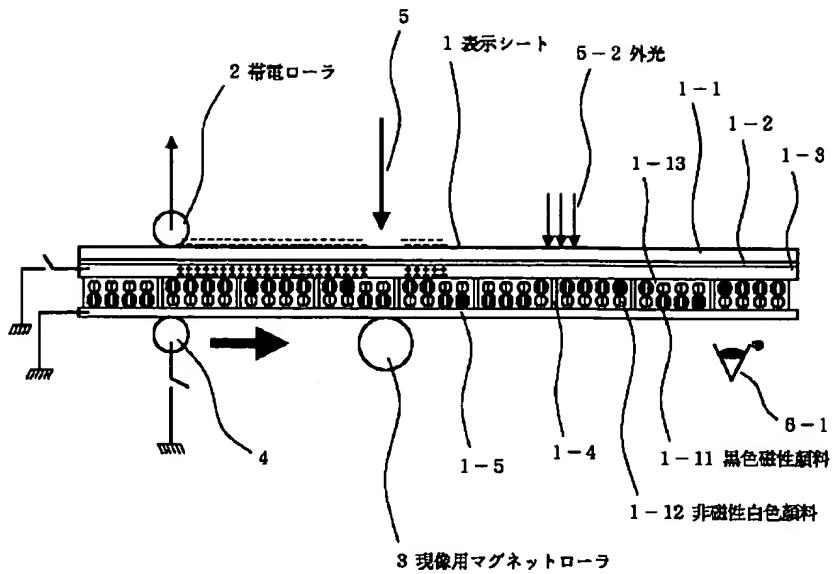
[Drawing 14]



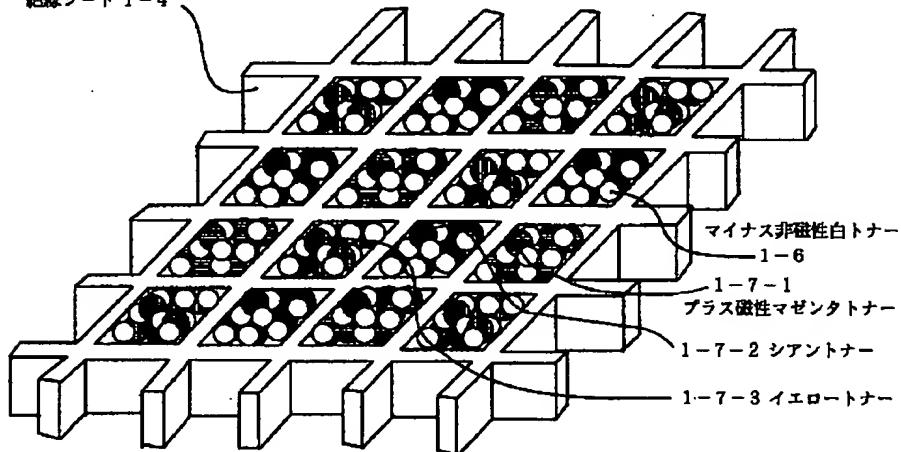
[Drawing 15]



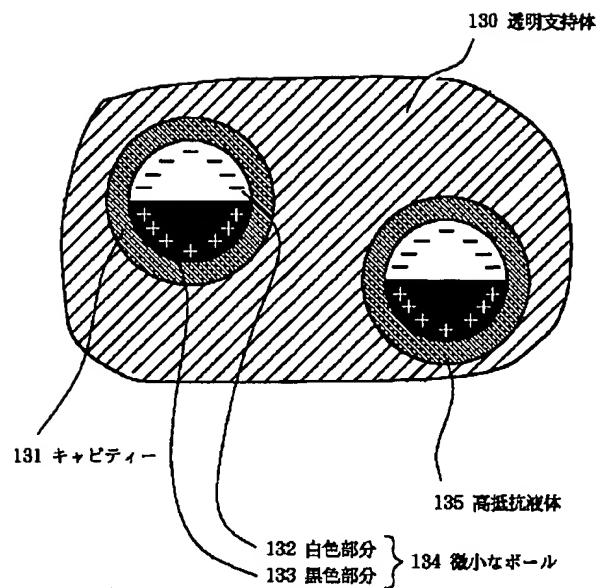
[Drawing 16]



[Drawing 17]  
絶縁シート 1-4

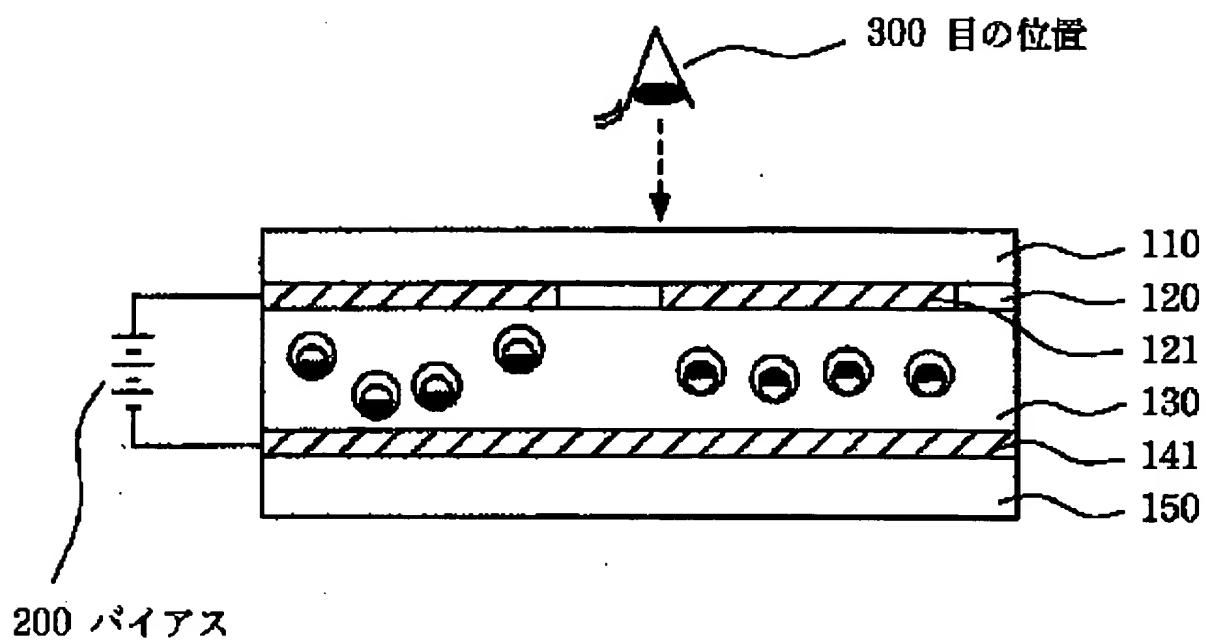


[Drawing 20]

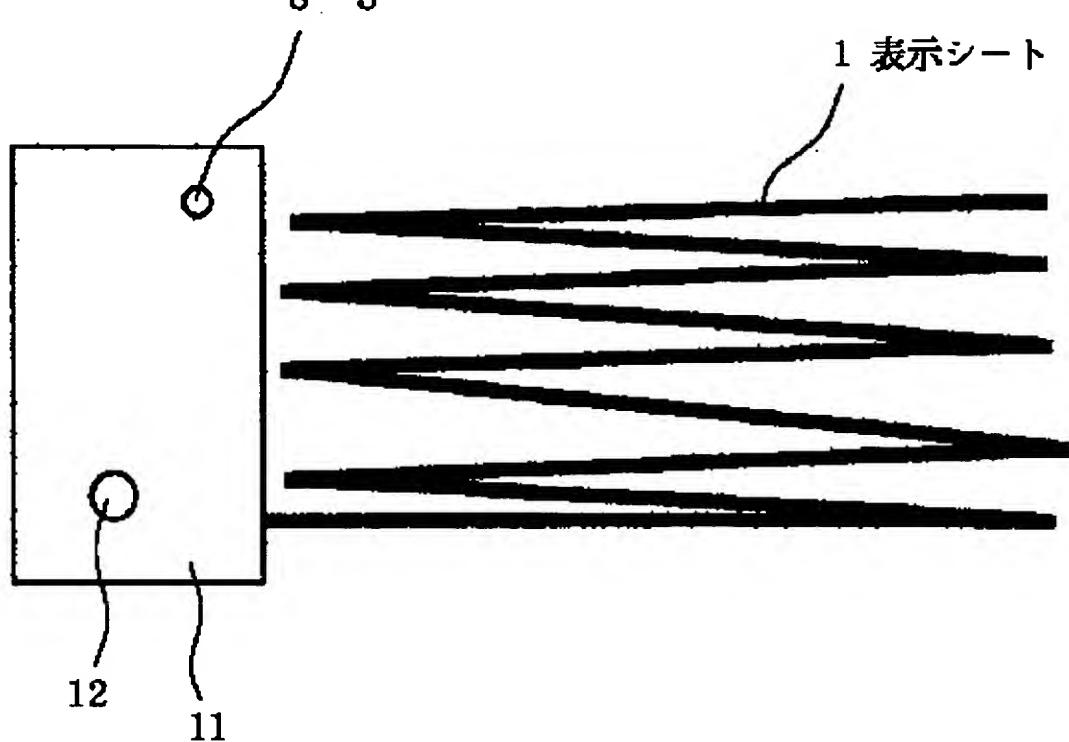


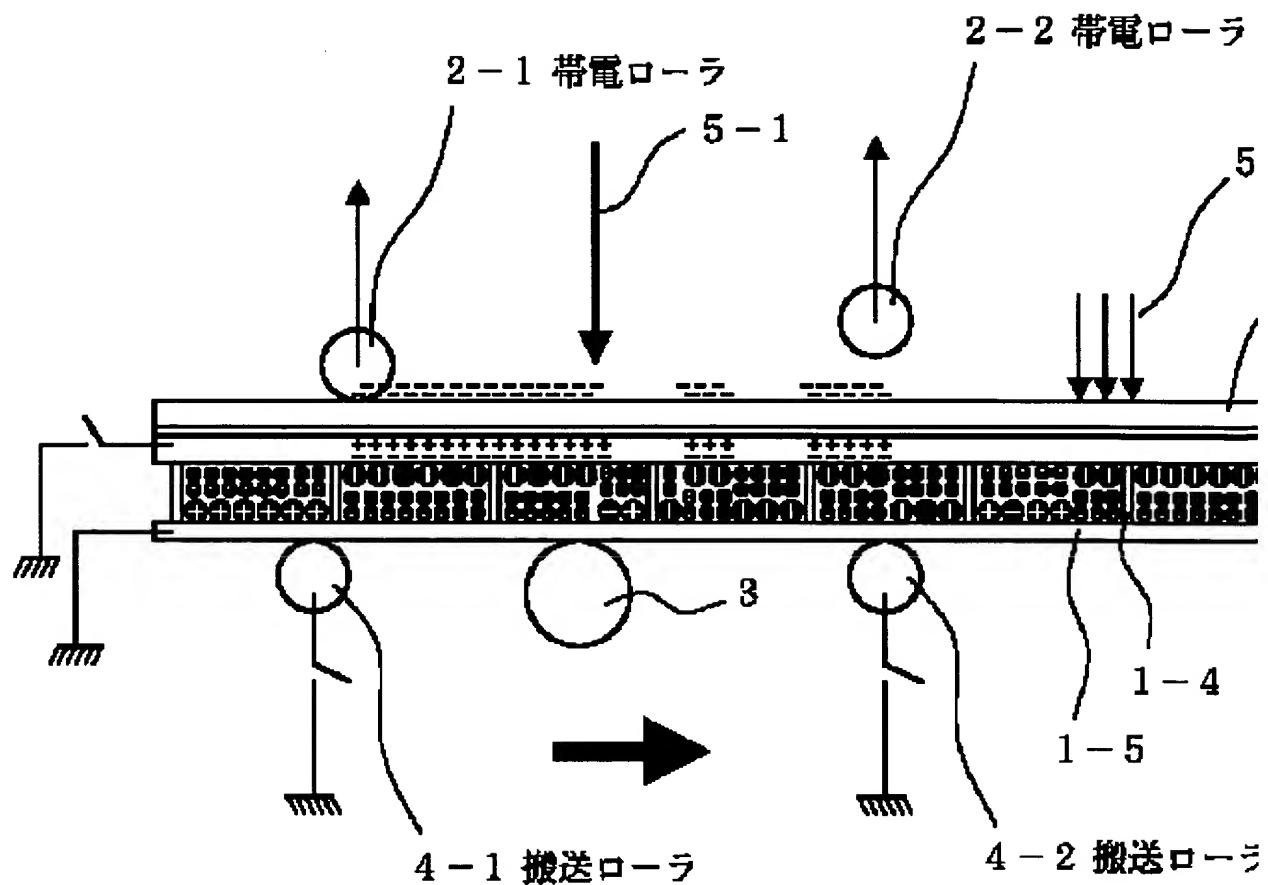
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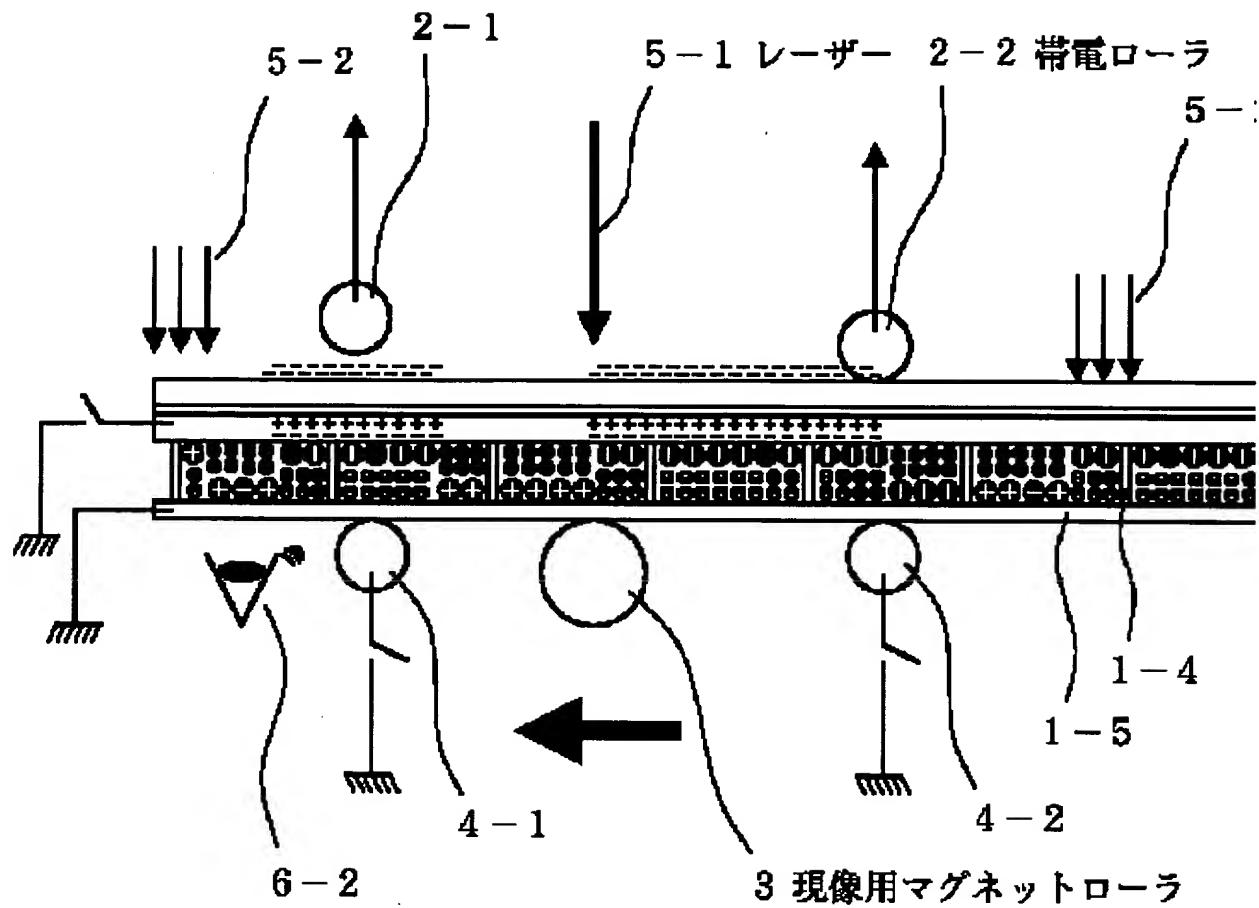
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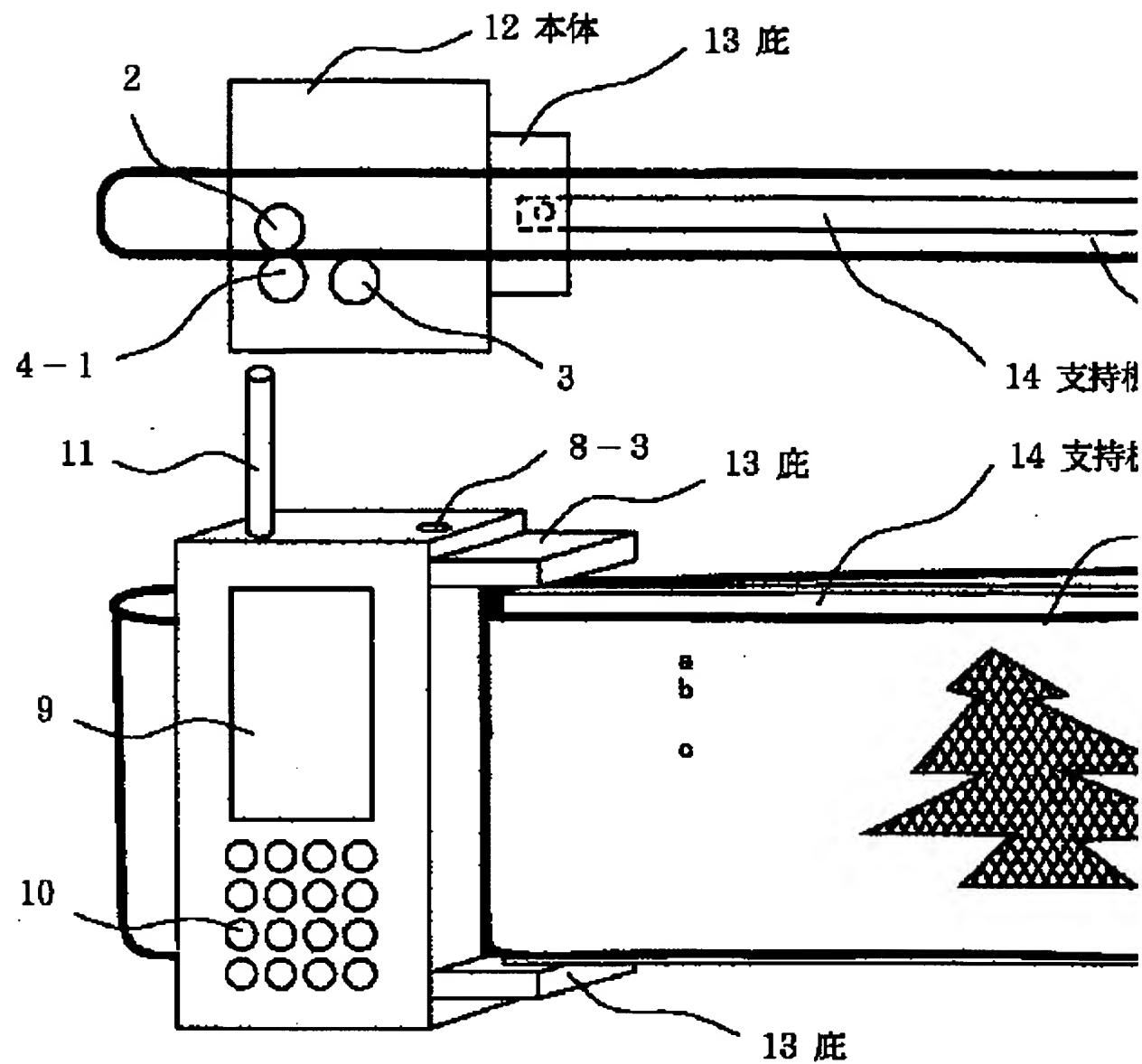


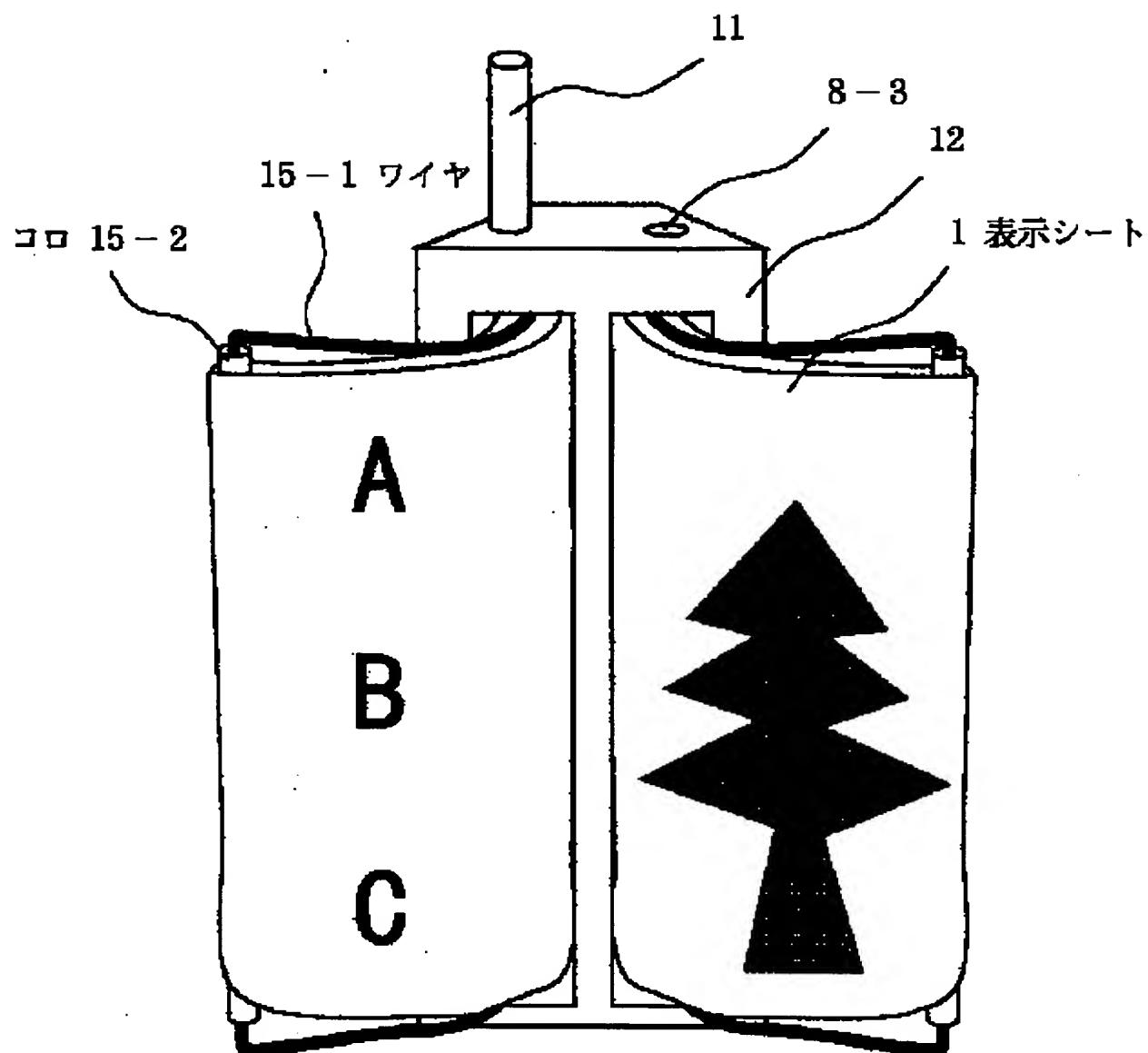
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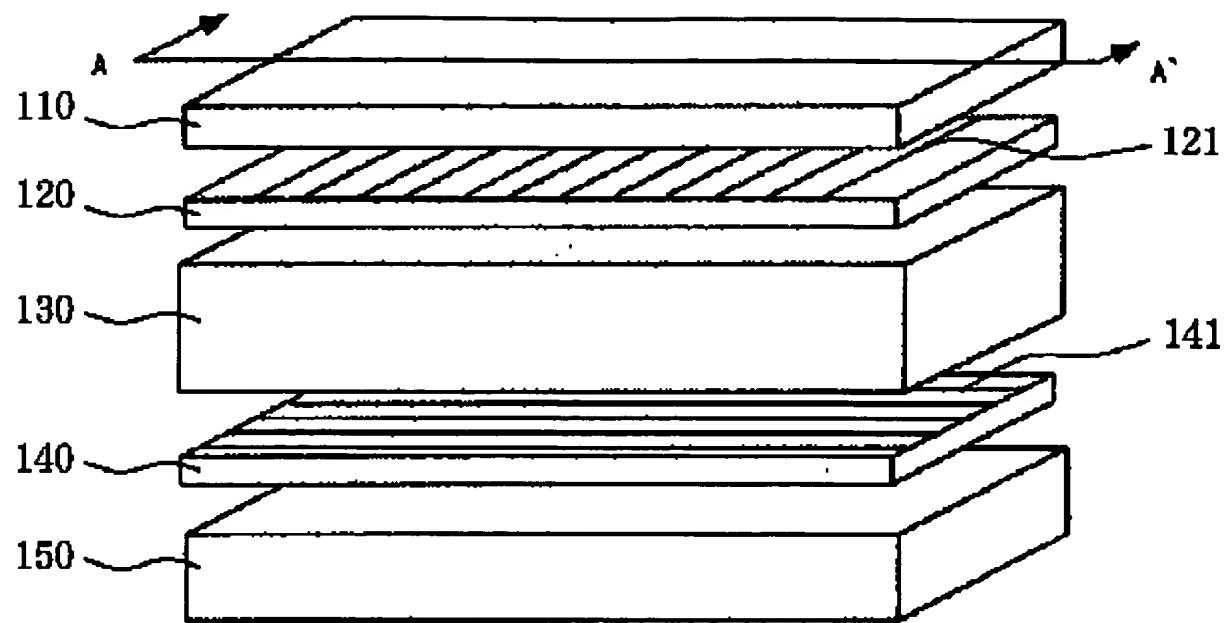




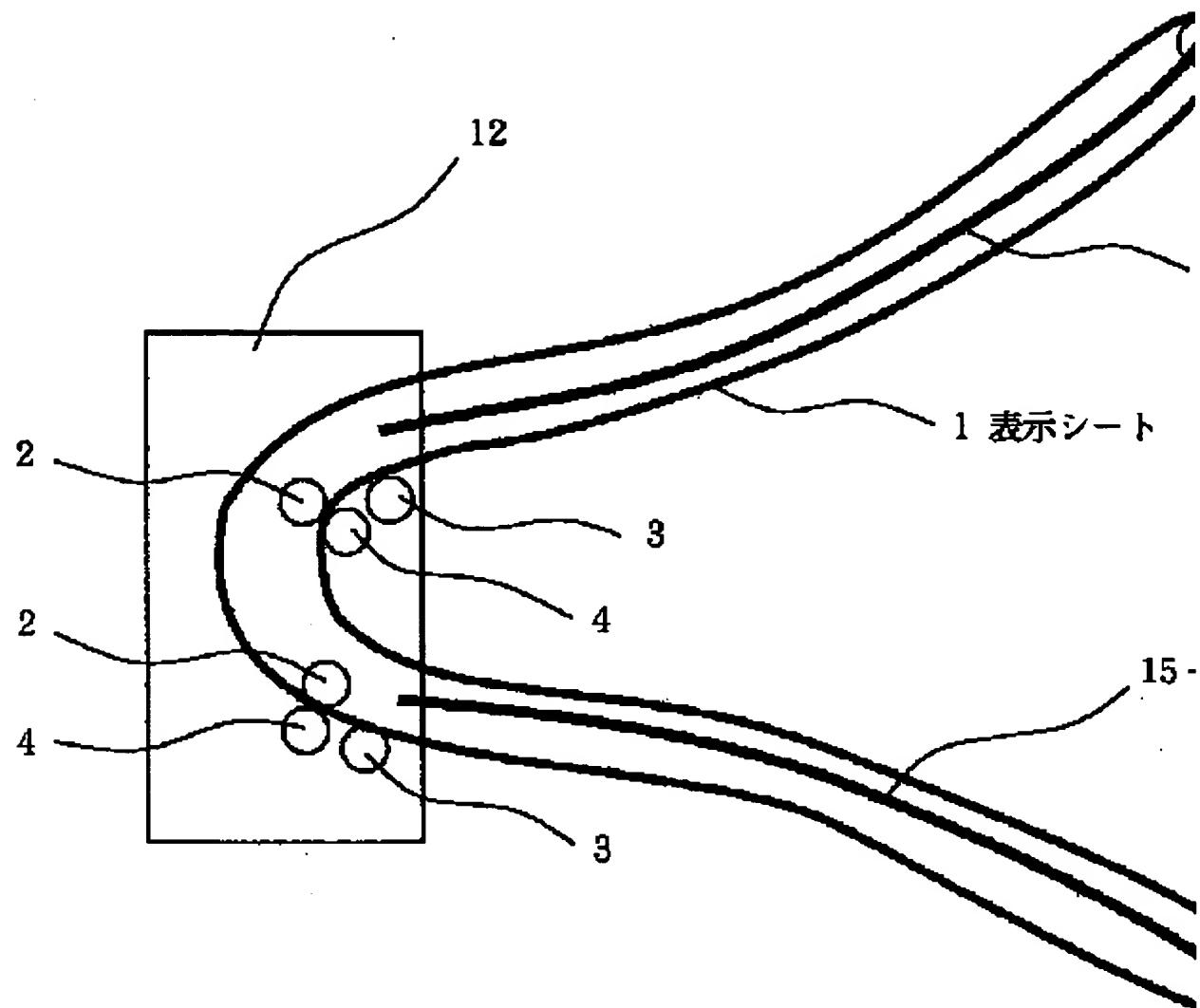


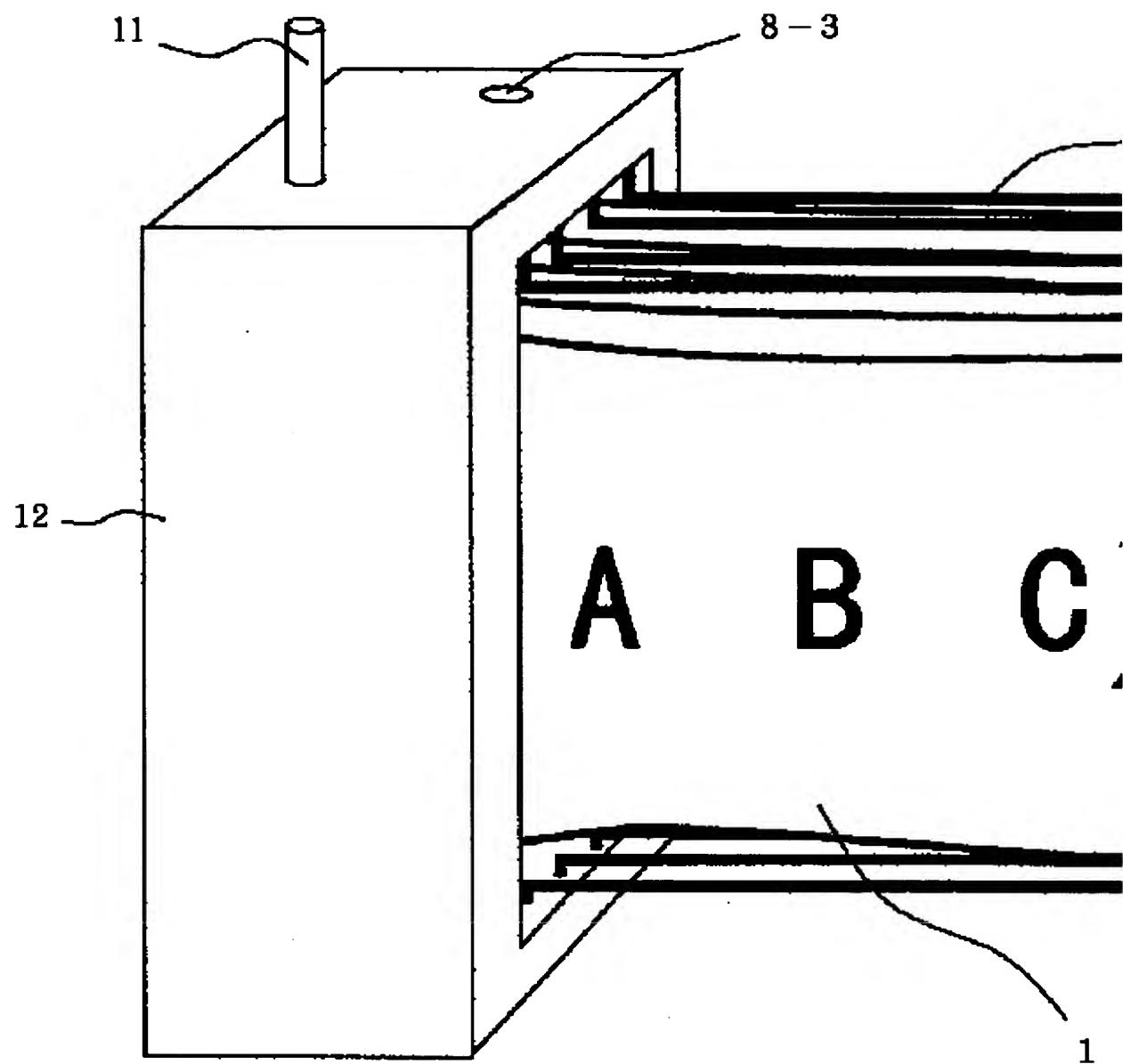




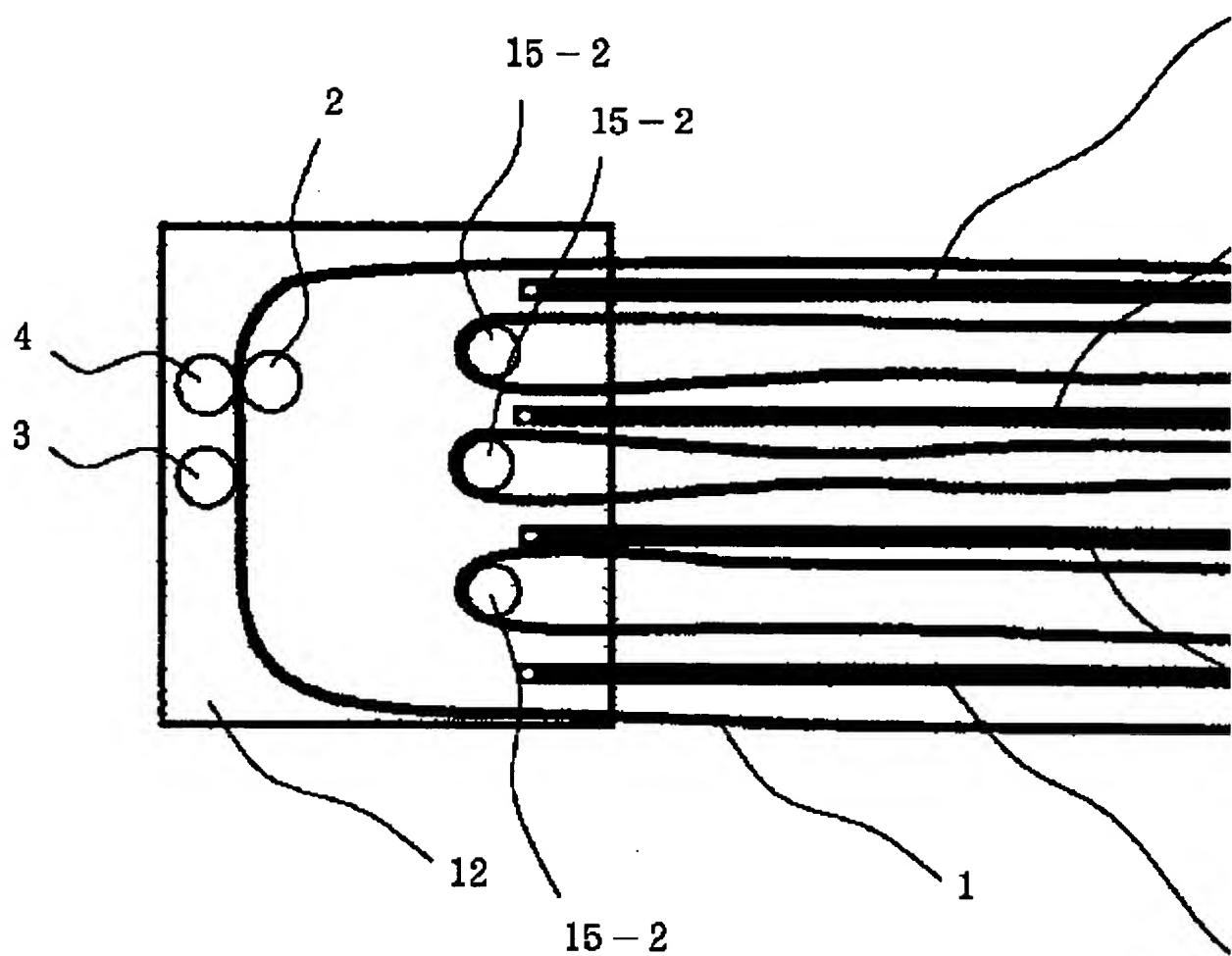


- 110 透明部材
- 120 電極支持体
- 121 平行透明電極
- 130 透明支持体
- 140 透明電極支持体
- 141 平行透明電極
- 150 基板

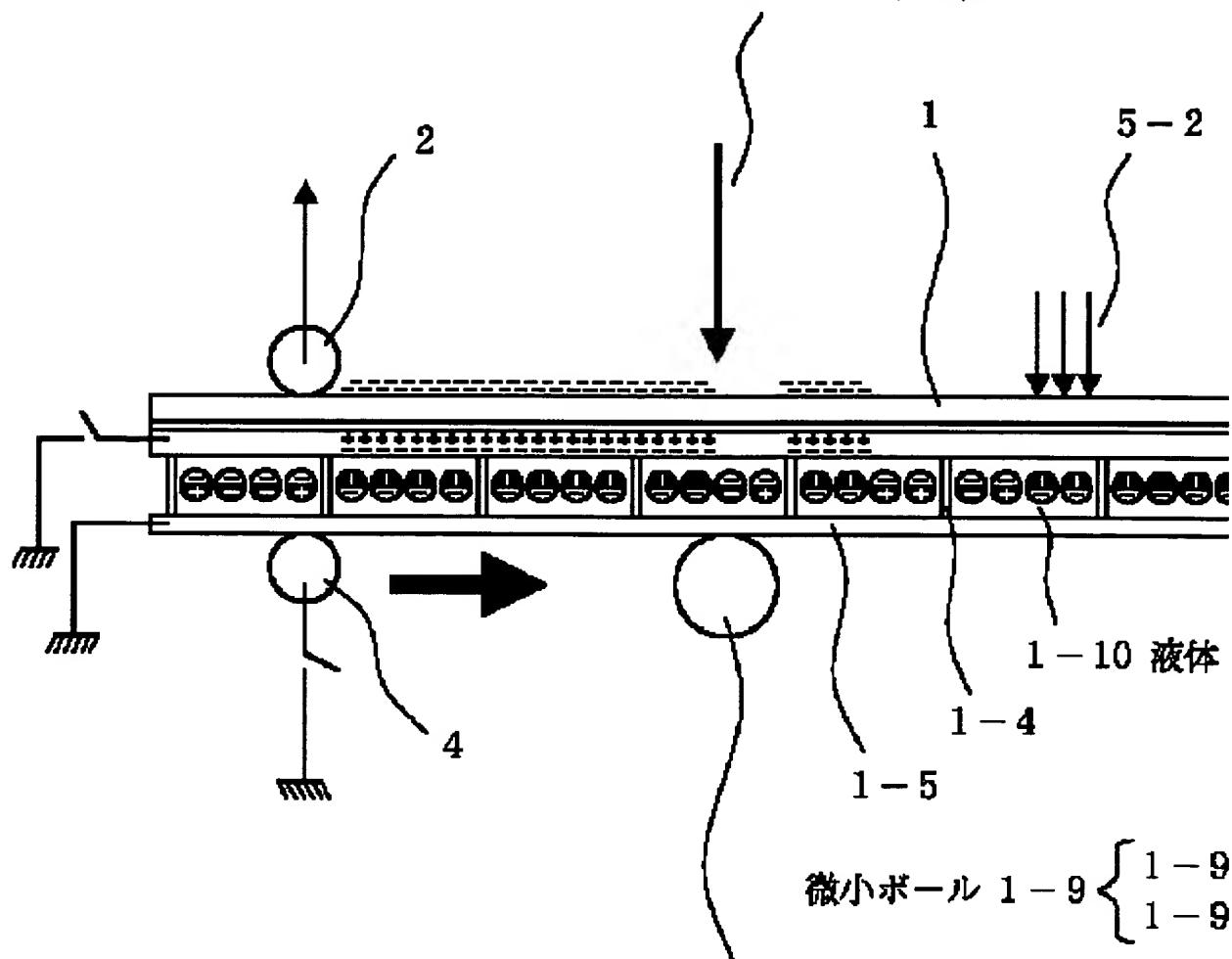




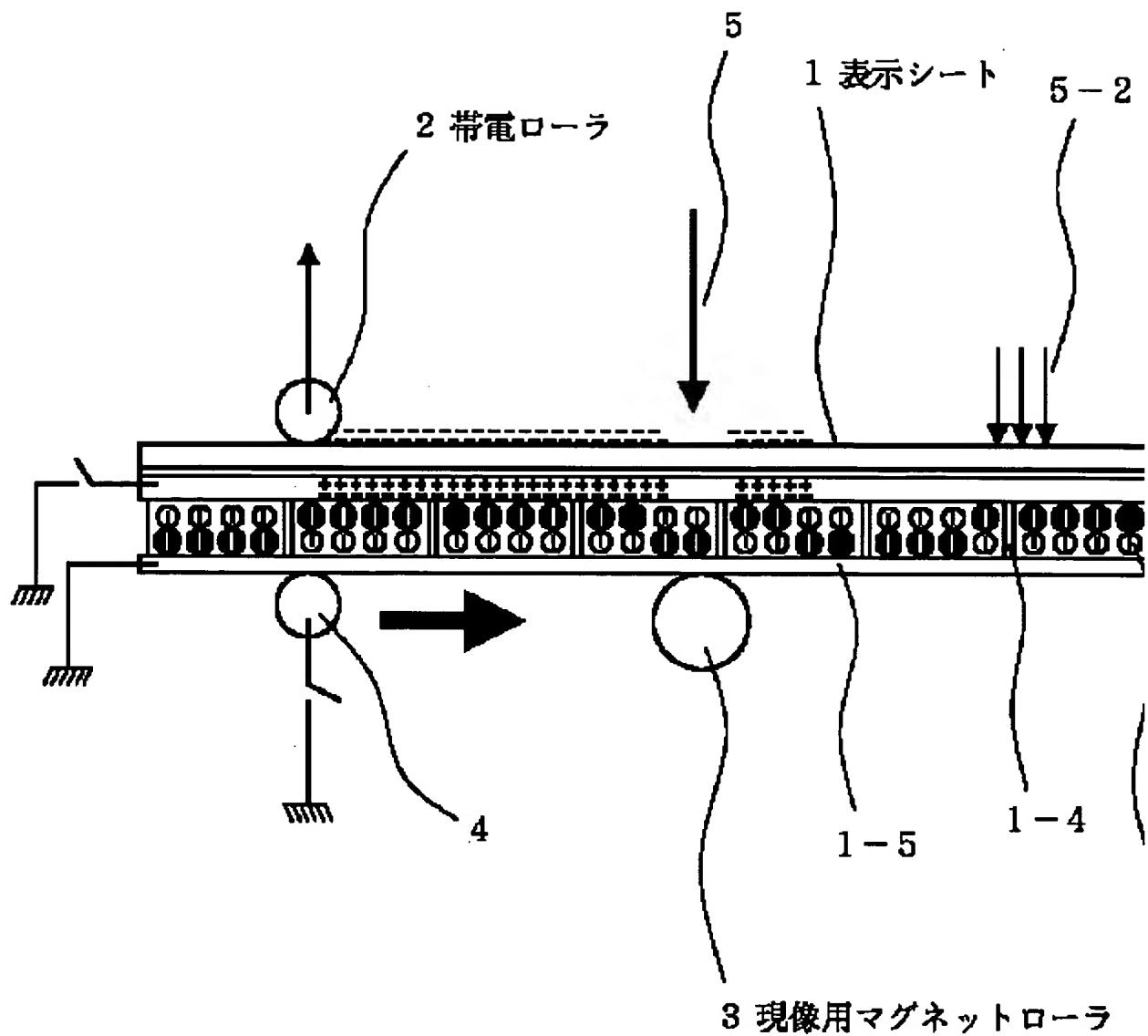
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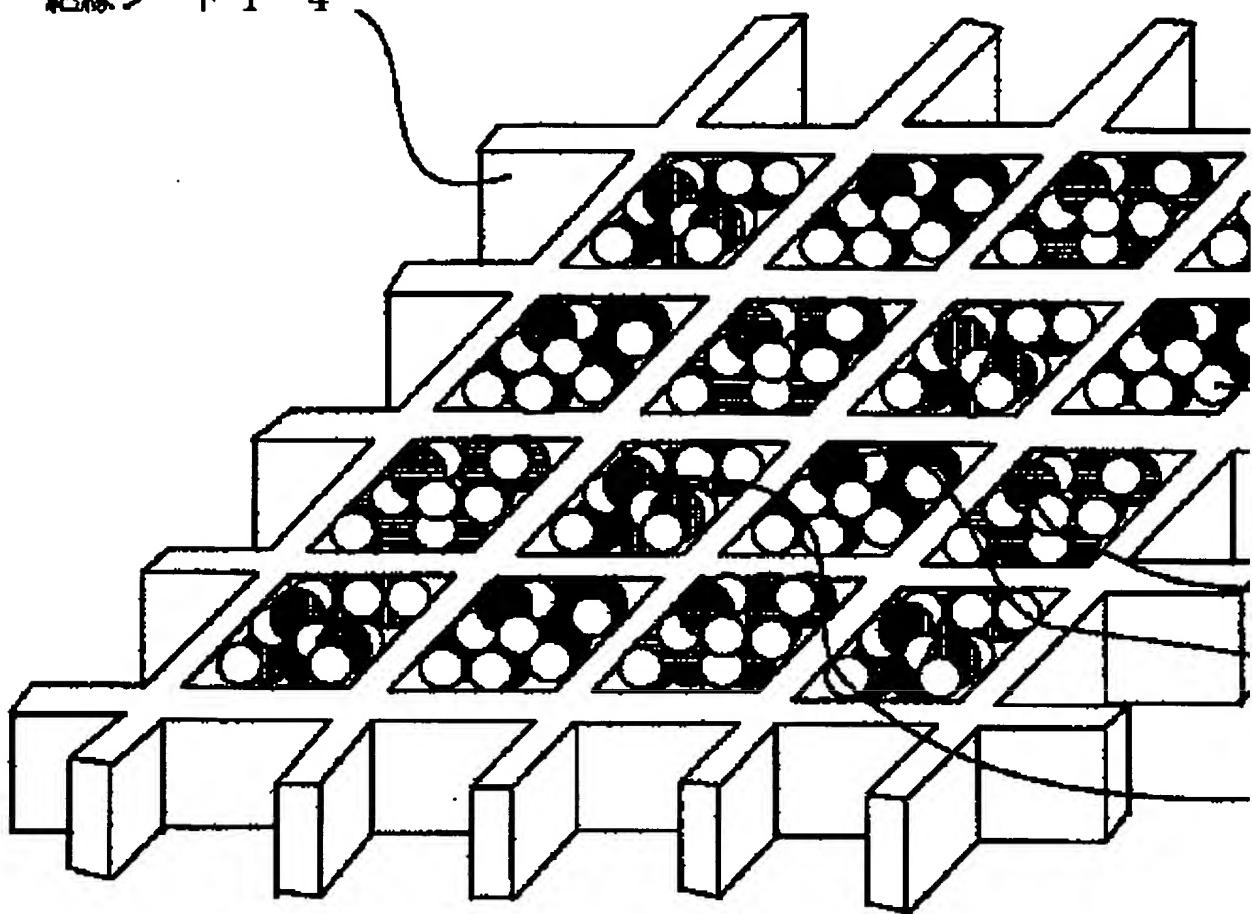
5-1 印字情報



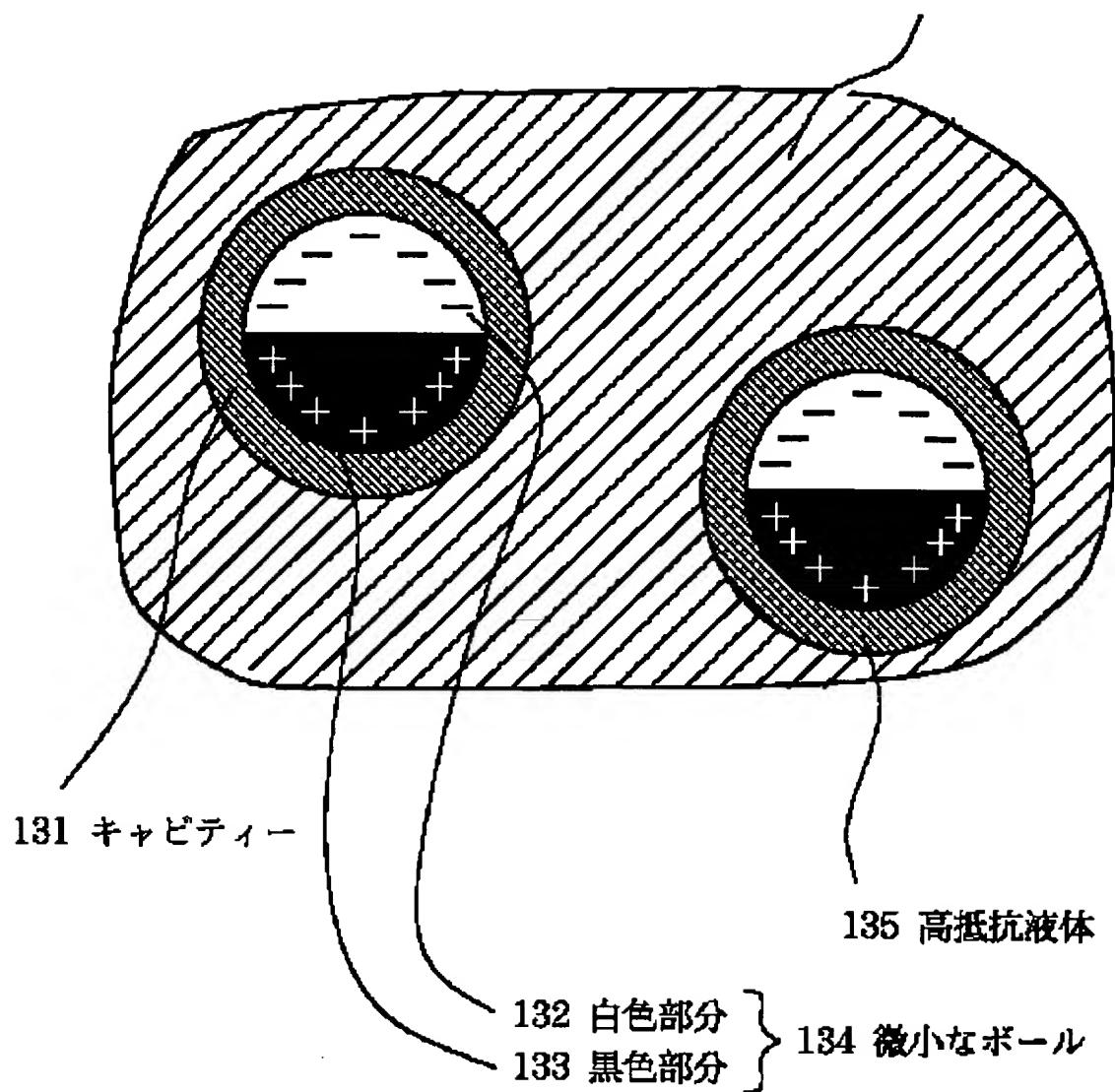
3 現像用マグネットローラ



絶縁シート 1-4



130 透明支持体



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